No. 81-2159

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IN THE

Supreme Court of the United States

OCTOBER TERM, 1981

BILL M. SILKWOOD, Administrator of the Estate of Karen G. Silkwood, Deceased,

Appellant,

vs.

KERR-McGEE CORPORATION, a Delaware corporation, and KERR-McGEE NUCLEAR CORPORATION, a Delaware corporation,

Appellees.

ON APPEAL FROM THE UNITED STATES COURT OF APPEALS FOR THE TENTH CIRCUIT

MOTION TO DISMISS OR AFFIRM

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MOTION TO DISMISS OR AFFIRM

The appellees, Kerr-McGee Corporation and Kerr-McGee Nuclear Corporation, respectfully move to dismiss this appeal or affirm the judgment below of the United States Court of Appeals for the Tenth Circuit.

STATEMENT OF THE CASE

The appellant's misleading statement of the case necessitates an additional explanation by the appellees of the decision below by the Tenth Circuit and the underlying facts.

The Tenth Circuit Opinion

The Tenth Circuit held that the district court should have granted the appellees judgment notwithstanding the verdict on the personal injury claim, since the evidence supported only the conclusion that Karen Silkwood's exposure to plutonium in November, 1974, occurred either at the job site or in preparation of a urine sample at the direction of her employer. Because all exposures were job-related, the Tenth Circuit correctly held that exclusive jurisdiction over the claim for personal injuries was vested in Oklahoma's Workers' Compensation Court.[1]

After reversing the underlying compensatory award for personal injuries, the Tenth Circuit reversed the punitive damage verdict because exclusive regulatory authority over radiation hazards is granted to the Atomic Energy Commission ["AEC"] by the Atomic Energy Act of 1954. The court below reasoned that since punitive damages were designed to punish reprehensible conduct and to deter others from similar conduct in the future, they had a regulatory effect. The Tenth Circuit held that a judicial award of exemplary damages under state law to punish or deter alleged unsatisfactory practices involving exposure to radiation was no less intrusive than direct legislative regulation of radiation hazards by a state and was, therefore, preempted by federal law.

The court affirmed an award in the stipulated amount of $5,000 for property removed from Silkwood's apartment during the decontamination process.

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[1] The appellant does not challenge here the correctness of the Tenth Circuit's holding disposing of Silkwood's personal injury claim on state law grounds. Moreover, that decision is not subject to review here. *See, e.g., City of Mesquite* v. *Aladdin's Castle, Inc.*, 102 S. Ct. 1070 (1982); *McCluney* v. *Jos. Schlitz Brewing Co.*, 102 S. Ct. 624 (1982) (Stevens, J. dissenting from summary affirmance); *Baxter* v. *Continental Casualty Co.*, 284 U. S. 578 (1931).

Statement of Facts

The appellant has set forth a slanted statement of facts, which is largely irrelevant to the current posture of the case. Within the constraints of brevity, the appellees shall correct a few of the more flagrant aspects of the appellant's statement (from which all record references are omitted).[2]

Karen Silkwood was a laboratory analyst employed by Kerr-McGee Nuclear Corporation at its Cimarron plutonium fuel fabrication facility. She was exposed to plutonium[3] on November 5, 6, and 7, 1974.[4]

By selectively citing and inaccurately paraphrasing the testimony of James Keppler, the regional director of the AEC, the appellant attempts to create the misimpression of unsafe operations, asserting that the appellees were cited for over seventy-five violations of AEC regulations and that AEC inspectors expressed harsh criticism of the Cimarron facility's

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[2] Citations herein are to the: report of proceedings in the district court ["R. ____"]; the appellant's jurisdictional statement ["J. S. ____"]; the appendix to the jurisdictional statement ["J. S. App. ____"]; and the appendix to this motion ["A. ____"].

[3] Plutonium is an artificially-produced, radioactive chemical element (R. 726) which has been instrumental in the development of nuclear power. The use and possession of plutonium, like other radioactive material, is carefully and comprehensively regulated by the federal government.

[4] An autopsy showed that the amount of plutonium in Silkwood's body at the time of her death, a week after the exposures, was 8.8 nanocuries. R. 7078; Defendant's Exhibit 37, A. 55. (Silkwood was killed in an automobile crash unrelated to this appeal.) Under standards established by the International Commission on Radiological Protection (ICRP) and the National Council on Radiation Protection (NCRP) and followed by the AEC, the permissible body burden for occupational workers is 40 nanocuries. At this level no adverse health effects are expected. *E.g.*, R. 7080, 9177-78.

operation. In fact, Mr. Keppler testified that the AEC viewed the plutonium plant as a "safe operation." R. 8158. Moreover, Kerr-McGee's operation of the plutonium plant never resulted in a fine by the AEC, or even a recommendation that such a fine be levied. R. 8157. Mr. Keppler further testified that there were no serious personnel exposures at the plutonium plant (R. 8255-6); that Kerr-McGee did not exceed the regulatory requirements with respect to exposure levels which would result in significant health hazards (R. 8256); and that under regulations and reporting requirements in effect at the time of trial, there would not have been even *one* exposure incident in 1973 or 1974 serious enough to warrant reporting it to the AEC. R. 8257.

The appellant's charge of malice toward Karen Silkwood is also totally unsupported. Indeed, it is fundamental to an understanding of the record below to recognize that the plaintiff totally failed to offer proof on the mechanism of Silkwood's exposure or the contamination of her apartment and that the plaintiff's counsel expressly conceded his inability to do so. *E.g.*, R. 3443. Having failed to prove how the exposures occurred, it is axiomatic that they were not proven to be the product of malice.

Instead of establishing evil intent, the record discloses that Kerr-McGee acted with great care and concern for Silkwood's safety and medical condition. *E.g.*, R. 7034-7036, 7043. In short, the undisputed facts are that when Silkwood was available, she received care and attention from Kerr-McGee; any delay was attributable solely to her own actions. *E.g.*, R. 7036, 7064.

Nor was there any evidence of malice or evil intent towards employees in general. The design of the plant and the equipment and processes utilized therein were "state of the art" and were approved by the AEC. R. 5497. Allegations of inadequate training and production at the expense of workers'

safety were thoroughly investigated by the AEC and found to be unsubstantiated. The AEC specifically concluded that the training curriculum emphasized health and safety procedures, pointed out the hazards associated with plutonium, and included adequate instruction on the biological effects of exposure. Defendants' Exhibit 38. The claim that Kerr-McGee concealed the hazards of plutonium from its workers through the omission of the word "cancer" and the use of arcane jargon incomprehensible to the workers is likewise baseless. The first sentence of the section of its health physics training manual dealing with the health effects of plutonium states, "... it is presently felt the major hazard from plutonium in man is malignancy." Defendants' Exhibit 5.

The appellant's discussion of the plant's physical security system in the context of this exposure is similarly misleading. Obviously, the security system was intended to prevent diversion of strategic quantities of plutonium, *i.e.* amounts which through repeated intentional removal, over time, could provide enough material to fashion a weapon. R. 7982. The physical security system was neither designed nor intended (nor required by the AEC) to prevent the removal of the minute quantity (less than .0003 grams) of plutonium involved in this case. R. 7980-1. The principal safeguard for prevention of the removal of minute quantities of plutonium was, in fact, self-monitoring by those who had authorized access to the restricted areas where plutonium was handled. R. 4531. Silkwood and other employees were required to monitor themselves at least five separate times between their work stations and the door to the plant. R. 4529-30, Defendants' Exhibit 144. Kerr-McGee's physical security system was in complete compliance with the AEC regulations at the time of Silkwood's exposure. Defendants' Exhibit 37, A. 14.

Inexplicably, the appellant asserts that he established at trial that the appellees violated the AEC regulations governing

radiation exposures with respect to Karen Silkwood. J. S. 11. Not only is this untrue, it is flatly contradicted both by the appellant's counsel's own admission at trial that he didn't know how Silkwood was contaminated (*E.g.*, R. 553) and his concession in the petition for rehearing below that:

> "... [N]o express license condition was violated by KM." Petition for Rehearing, p. 14, n. 20.

As the appellant well knows, Kerr-McGee's license was "subject to all applicable rules, regulations, and orders of the Atomic Energy Commission." Defendants' Exhibit 2.

The AEC made an exhaustive investigation into Silkwood's exposures to plutonium. Defendants' Exhibit 37, A. 1, *et seq.* The AEC's final report of this investigation contains a detailed chronology of the events relating to Silkwood's contamination and decontamination, analyses of bioassay data, and specific factual conclusions. The AEC concluded that Silkwood received less than one-half of the maximum permissible body burden of plutonium from the exposure incidents and further concluded that Kerr-McGee's only violation of regulations was the failure to maintain a record of the voiding dates on two bioassay samples submitted by Silkwood. Defendants' Exhibit 37, A. 17. This violation, which occurred because Silkwood failed to supply Kerr-McGee with the voiding dates, was not causally related to her exposure or alleged injury in any way. There is, in fact, no basis for the claim that Kerr-McGee was not in complete compliance with federal regulations as they pertained to Silkwood.

MOTION TO DISMISS

Appellate Jurisdiction Does Not Lie for This Appeal Under § 1254(2).

This appeal should be dismissed for the reason that the Court of Appeals below did not hold a state statute to be invalid as repugnant to the Constitution, treaties or laws of the United States. 28 U. S. C. § 1254(2).

The state statute asserted to provide the basis for jurisdiction here is the Oklahoma punitive damages statute, 23 O. S. § 9, which permits a jury to award exemplary damages where a defendant has been guilty of oppression, fraud or malice. After reversing the compensatory award for personal injuries, the Tenth Circuit held that under the Atomic Energy Act any state action that competes substantially with the Nuclear Regulatory Commission in its regulation of radiation hazards is preempted. The court then held that "punitive damages may not be awarded in this case." J. S. App. 24a. However, the court below never addressed, analyzed or ruled on the validity of the punitive damages statute itself. In fact, nowhere in the Tenth Circuit's opinion is the statute even mentioned.[5] It is respectfully urged that this is *not* tantamount to a holding that the Oklahoma punitive damages statute is invalid.

In failing to demonstrate any consideration of the Oklahoma statute by the Tenth Circuit, the appellant has failed to establish any basis for an appeal under the narrowly-interpreted § 1254(2). In comparable situations where jurisdic-

[5] The transparency of the appellant's attempt to bootstrap appellate jurisdiction here is demonstrated by his argument that the decision below violated "standards respecting preemption of common law rights" (J. S. 17); *see also* Judge Doyle's dissent (J. S. App. 32a) (stating that the issue in this case is whether the Atomic Energy Act impliedly preempts part of Oklahoma's *common law* remedy).

tion was claimed under § 1257(2), appeals have been dismissed. *See, May* v. *Anderson*, 345 U. S. 528, 530 (1953) (appeal would not lie where the state statute alleged to be the basis for appeal was not considered by the court below); *Kulko* v. *Superior Court of California*, 436 U. S. 84, 90 (1978) (appeal dismissed because opinion below did not purport to determine the constitutionality of a California statute).

Even where consideration of a state statute is clear, such decisions limiting the applicability of statutes under the Supremacy Clause do not in all instances constitute a finding that such statutes are invalid. In *Minnesota* v. *Hoffman*, 543 F. 2d 1198 (8th Cir. 1976), *appeal dismissed for want of jurisdiction, sub nom., Minnesota* v. *Alexander*, 430 U. S. 977 (1977), the Eighth Circuit held that the State of Minnesota was prohibited by reason of the Supremacy Clause from applying state water pollution regulations to the Army Corps of Engineers. The appeal to this Court under § 1254(2) was dismissed.

The cases relied upon by the appellant (J. S. 2-3) are readily distinguishable. In each, a specifically identified statute is expressly held to be invalid, either facially or as applied, by the court of appeals. In each, the challenged statute is fully analyzed and is the focus of the court's holding. Here the Oklahoma statute is never identified as being the subject of the holding, nor is any consideration by the court below of the statute's validity or applicability to these unique facts articulated or even disclosed. This is particularly germane where, as here, the compensatory award for alleged personal injuries upon which the punitive damage claim was premised, has itself been reversed on state grounds.

MOTION TO AFFIRM

A. This Court Should Affirm the Tenth Circuit's Ruling That an Award of Punitive Damages Is Preempted in This Case.

The Jurisdictional Statement distorts the holding and impact of the decision below respecting punitive damages and seeks an unwarranted disruption in the orderly, and heretofore consistent, growth of the law surrounding federal regulation of radiation hazards.[6] The Tenth Circuit simply held that the imposition of punitive damages in this case constitutes state regulation of radiological hazards which conflicts with the regulatory scheme of the Atomic Energy Act and is therefore preempted. In so holding, the Tenth Circuit was forging no new legal principles, but merely following sound, established legal precedent of this Court and the lower federal courts.

The Tenth Circuit Correctly Held That the Imposition of Punitive Damages Is Preempted by the Atomic Energy Act.

The Atomic Energy Act of 1946 codified Congressional concern over the control of radioactive materials by providing the AEC with a monopoly on the ownership, production and use of all fissionable material. Ch. 724, 60 Stat. 755. Recognizing the great potential for peaceful use of atomic power,

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[6] The *Pacific Gas and Electric* case, now before this Court on writ of certiorari, does not present an issue which would affect the outcome of this case. *Pacific Legal Foundation* v. *State Energy Resources Conservation and Development Comm.*, 659 F. 2d 903 (9th Cir. 1981), *cert. granted sub nom., Pacific Gas & Electric* v. *State Energy Resources Conservation and Development Comm.*, 50 U. S. L. W. 3994 (June 21, 1982). There, a state statute was upheld by the Ninth Circuit against a Supremacy Clause challenge on the basis that it was enacted "for purposes other than protection against radiation hazards." 659 F. 2d at 923. Neither the Ninth Circuit's decision nor the argument of either party challenges the principle of federal supremacy in the regulation of radiation hazards. The issue on certiorari is whether the particular California laws there in question invade that exclusive federal province. Thus, the case does not call into question the consistent series of decisions holding that federal law has preempted the regulation of radiation hazards.

Congress, by the Atomic Energy Act of 1954, 42 U. S. C. § 2011, *et seq.*, allowed private participation in the development of nuclear energy but only under a comprehensive statutory program of federal licensing and regulation described as "a regulatory scheme which is virtually unique in the degree to which broad responsibility is reposed in the administering agency." *Siegel* v. *AEC*, 400 F. 2d 778, 783 (D. C. Cir. 1968). The expressed dual purpose of the Act was to foster the peacetime use of atomic energy and to protect the public from undue radioactive hazards. 42 U. S. C. §§ 2011-13.

The 1954 Act provided the AEC with extensive regulatory and rule-making authority, and charged the AEC with the duty to formulate regulations to protect public health and safety. 42 U. S. C. § 2201(b). In 1959 Congress amended the Act by adding Section 274 to clarify the responsibilities of the states and the AEC with respect to control of by-product, source and special nuclear material. 42 U. S. C. § 2021. This section establishes procedures and criteria for the discontinuance by the AEC (and "assumption" by the states) of certain specified responsibilities, otherwise within exclusive AEC domain. But such an assumption can only take place if a state enters into a "Section 274 Agreement" with the AEC (NRC).[7] Oklahoma has never entered into such an agreement and the Commission has surrendered none of its authority to regulate nuclear materials.

The exclusivity of the NRC's jurisdiction as well as the need and purpose for such exclusivity was clearly enunciated in

[7] In favorably reporting the section 274 legislation, the Joint Committee on Atomic Energy declared that "the Commission has exclusive authority to regulate for protection against radiation hazards until such time as the State enters into an agreement with the Commission to assume such responsibility." S. Rep. No. 820, 86th Cong., 1st Sess., 12, *reprinted in* 1959 U. S. Code Cong. & Admin. News 2872, 2883. *See also, Hearings before the Joint Committee on Atomic Energy on Federal-State Relationships in the Atomic Energy Field*, 86th Cong., 1st Sess., 287-316 (1959).

Northern States Power Co. v. *Minnesota*, 447 F. 2d 1143 (8th Cir. 1971), *aff'd mem.*, 405 U. S. 1035 (1972):

> The nature of the subject matter regulated and the need for uniform controls in order to effectuate the objectives of Congress are additionally supportive of a finding of pre-emption. In enacting the Atomic Energy Act of 1954, Congress made specific findings concerning the development, use and control of atomic energy. Included in these findings are a number of statements to the effect that the processing and utilization of source, by-product and special nuclear material *must be regulated by the United States in the national interest* because of their effect upon interstate and foreign commerce and in order to provide for the common defense and security and to protect the health and safety of the public. (Emphasis in original).

Id. at 1153.[8]

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[8] In *Northern States* the preemption arose out of the Atomic Energy Act of 1954, as amended. As far as state regulation is concerned, the sole savings clause in the Act permits states to regulate activities "for purposes *other than protection against radiation hazards*," § 2021(k) (emphasis added). *See Hearings Before the Joint Committee on Atomic Energy on Federal-State Relationships in the Atomic Energy Field*, 86th Cong., 1st Sess. 492-93 (1959) during which the following exchange occurred:

> Mr. Ramey: Is it not the Commission position, that without the lead-off language of subsection [274]k, [that state regulation was to be permitted only pursuant to the agreements authorized by Section 274(b)], the same result is legally intended and legally effective?
>
> Mr. Lowenstein: Yes.
>
> • • •
>
> Chairman Anderson: You have preempted the field, have you not?
>
> Mr. Lowenstein: Yes, sir.

Here Silkwood does not even contend that the purpose of the punitive damages award was to punish or deter activities other than those involving radiation hazards.

The holding of *Northern States* was subsequently reaffirmed by this Court in *Train* v. *Colorado Public Interest Research Group*, 426 U. S. 1, 16 (1976), where the Court recognized the "absence of any room for a state role" in the regulation of radiological hazards. Moreover, contrary to any assertions made in the Jurisdictional Statement, recent circuit court case law demonstrates the continued vitality of *Northern States*. *See Illinois* v. *Kerr-McGee Chemical Corp.*, 677 F. 2d 571, 581 (7th Cir. 1982) ("[T]he Atomic Energy Act has expressly and impliedly preempted regulation by the states of the radiation hazards associated with nuclear materials."); *Pacific Legal Foundation* v. *State Energy Resources Conservation and Development Comm.*, 659 F. 2d 903, 921 (9th Cir. 1981), *cert. granted sub nom., Pacific Gas & Electric* v. *State Energy Resources Conservation and Development Comm.*, 50 U. S. L. W. 3994 (June 21, 1982) ("[The legislative history of section 274] demonstrate(s) Congress's intent to assert exclusive federal control over the radiation hazards associated with nuclear materials.").[9]

Silkwood attempts to avoid the impact of *Northern States* by noting that this case involves no state "regulations" or state agency. J. S. 15. Certainly this is a distinction without a difference and stems from a fundamental misunderstanding of the nature and function of punitive damages. Unlike compensatory damages, punitive damages "are private fines levied by civil juries to punish reprehensible conduct and to deter its future occurrence". *Gertz* v. *Robert Welch, Inc.*, 418 U. S. 323,

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[9] Appellant argues that *Northern States* is no longer viable (J. S. 16-17), because the Clean Air Act Amendments of 1977 expressly permit state regulation of radiation emissions under certain specific and limited circumstances. Such specific delegation of limited authority to the states by federal statute is entirely consistent with underlying and continuing federal control of all nuclear radiation hazards not covered by such specific delegation. In short, the doctrine of *Northern States* is alive in all areas of control of nuclear radiation hazards, except those specifically delegated to the states by federal statute.

350 (1974). The primary purpose for imposition of punitive damages has been the regulation of conduct through punishment and deterrence. Restatement (Second) of Torts § 908(1), Comment a (1979); Comment, *Implied Preemption of Punitive Damages for Nuclear Accidents*, 29 American U. L. Rev. 741, 756 (1980). In fact, under Oklahoma law, if a punitive award will neither punish nor have a deterrent effect, the award will be disallowed. *Nixon* v. *Oklahoma City*, 555 P. 2d 1283, 1285 (Okla. 1976). The punishment-deterrent rationale was explicitly recognized by the trial judge in his instructions to the jury. J. S. App. 112a.

In imposing punitive damages, the jury and the district court were prescribing the manner in which Kerr-McGee must conduct operations in its plant. The regulatory intent and impact of a punitive damages award is at least as forceful and intrusive as a law issued by a state legislature or a regulation promulgated by a state administrative agency. Indeed, the *ad hoc* imposition of punitive damages is more pernicious than a statute or formal regulation, because the arbitrary and uncontrollable features of the award, recognized in *International Brotherhood of Electrical Workers* v. *Foust*, 442 U. S. 42, 50-51 n.14 (1979), prevent a uniform system of regulation and are not balanced with the stated Congressional purpose of promoting nuclear energy.

In fact, the particular circumstances of this case illustrate why the imposition of punitive damages *is* a form of regulation. Here, not only is there no evidence of deliberate or even reckless violation of a regulation causing the claimed injury to Silkwood or her personal property, *there was no evidence of any violation which was shown to be the cause of Silkwood's alleged injuries or the damage to her personal property.*[10] *See* discussion

[10] Significantly, the appellant has not cited a single case in which punitive damages have been awarded despite compliance with a

(Footnote continued on following page)

pp. 5-6, *supra*. The alleged misconduct on which Silkwood sought to base the punitive damage award had to do with the general operation of the facility and the alleged general attitude of the company with respect to safety. Thus, it is clear that any award of punitive damages in this case would be nothing more than an attempt to regulate generally the operation of the plant. As such, it is clearly preempted under the Atomic Energy Act and by the reasoning of the *Northern States* case and its progeny.

The Purpose Underlying the Price-Anderson Act Is Inconsistent With an Award of Punitive Damages.

The appellant's reliance on portions of the legislative history of the Price-Anderson Act is misplaced. The complete legislative history of the Act demonstrates that its two basic purposes are to assure the availability of funds to compensate victims of a catastrophic nuclear incident and to encourage private industrial participation in the nuclear energy program. S. Rep. No. 650, 89th Cong. 1st Sess. 4, *reprinted in* 1965 U. S. Code Cong. & Admin. News 3209, 3212. That the Price-Anderson Act contemplates public liability protection for *compensatory* rather than punitive damages is evidenced by section

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(Footnote continued from preceding page)

preemptive federal regulatory scheme. Rather, he relies on this Court's decision in *Nader* v. *Allegheny Airlines, Inc.*, 426 U. S. 290 (1976). J. S. at 19. That decision, unlike the subsequent court of appeals decision in the same case, dealt with primary jurisdiction rather than federal preemption, and did not address the question of punitive damages. The Court simply held that a particular section of the Federal Aviation Act was not inconsistent with and did not abrogate common law liability for misrepresentation. The question of punitive damages *was* subsequently considered by the court of appeals, which held that the award of punitive damages was *improper* because there had been compliance with the federal regulations involved. *Nader* v. *Allegheny Airlines, Inc.*, 626 F. 2d 1031, 1035 (D. C. Cir. 1980). *See* discussion at p. 20, *infra*.

2210(c) (limiting government indemnity to $500,000,000), section 2210(e) (limiting total liability of licensees to $560,000,000), and section 2210(o) (authorizing the district court to supervise distribution of limited fund to claimants, and to establish priorities between claimants and classes of claims). If punitive damages were recoverable, the Act's dual objectives would be defeated. The risk of impediments to private development would not be removed, and "windfall" punitive recoveries to some claimants could reduce the amount available as compensation to other claimants. In short, in this comprehensive Congressional scheme for public liability protection, there is no justification—no *raison d'être*—for punitive damages. Thus, the reference to state tort law in the legislative history must be read as referring to state tort law for purposes of compensation.

In focusing on Price-Anderson, the appellant has lost sight of the legislative history of the Atomic Energy Act as a whole (which specifically governs the operation of Kerr-McGee's plant). This history shows explicitly that Congress intended that radiological hazards be subject to exclusive federal control. *Northern States, supra.* Punitive damages would clearly conflict with this intention. *See* Comment, *Implied Preemption of Punitive Damages,* 29 American U. L. Rev. 741, 767 (1980) ("Although a goal of Price-Anderson may have been to keep interference with state tort law to a minimum, it clearly did not authorize states to regulate radiation hazards through the granting of punitive awards.").

The Tenth Circuit Opinion Does Not Deprive Citizens of Any Common Law or Constitutional Rights.

The appellant's argument that the Tenth Circuit's decision on punitive damages deprives citizens of a fundamental right to be compensated or made whole for wrongs committed against them ignores the nature of punitive damages. As noted above, the purpose of punitive damages is not to compensate the

plaintiff. Indeed, to the plaintiff, punitive damages are a windfall because their purpose is to punish the defendant and to deter future conduct. They are, in effect, a common law substitute for a legislative fine or penalty, except that the money goes to the plaintiff rather than the state. The decision below leaves intact whatever rights a citizen may have under state law to recover for any loss or damage he has incurred, while at the same time preserving the federal government's exclusive interest in deterring or punishing improper conduct relating to radiation hazards. The appellant argues that the imposition of punitive damages lies within a state's "police powers" and therefore, preemption should not be readily inferred. J. S. 17-19.[11] The purposes underlying the Atomic Energy Act, however, show that Congress specifically considered the health and welfare of the public in determining that the AEC, an agency with expertise and experience in radiological matters, is best equipped to evaluate potential hazards and protect the public health and safety. *See* discussion of *Northern States, supra.*

Nor does the Tenth Circuit's decision create equal protection or due process problems for failure to provide a substitute for punitive damages. J. S. at 26-27. As this Court stated in *Duke Power Co.* v. *Carolina Environmental Study Group, Inc.*, 438 U. S. 59, 88 (1978), "it is not at all clear that the Due Process Clause in fact requires that a legislatively enacted compensation scheme either duplicate the recovery at common

[11] Appellant claims that when state police powers are involved, "the presumption should be against federal preemption of the state law," J. S. 19 & n.27. The cases cited for this proposition, however, merely state: "in the absence of compelling Congressional direction, we could not infer that Congress had deprived the States of the power to act." *San Diego Building Trades Council* v. *Garmon*, 359 U. S. 236, 244 (1959); *New York Telephone Co.* v. *New York Labor Dept.*, 440 U. S. 519, 540 (1979). In the area of radiological hazards, the relevant legislative history and case law clearly demonstrate a compelling Congressional direction that state law be preempted.

law or provide a reasonable substitute remedy," citing several cases, *e.g., Silver* v. *Silver,* 280 U. S. 117, 122 (1929) (the "Constitution does not forbid the creation of new rights, or the abolition of old ones recognized by the common law, to attain a permissible legislative object"). Moreover, there *is* a *quid pro quo* here. Extensive regulation by a federal agency for the protection of the public has been established, with sanctions such as heavy fines and license revocation available and often invoked, to secure compliance, deter prospective wrongdoers, and punish offenders. *See, e.g., Wall Street Journal,* March 22, 1982, at 14 (Boston Edison pays $550,000 fine levied by NRC).

The appellant's argument that an NRC licensee could intentionally contaminate someone and be immune from punishment (*e.g.* J. S. 12) is fatuous. Such an assertion has no application to this case, where there was no evidence that either Silkwood or her personal property were deliberately contaminated by Kerr-McGee. R. vol. 52, pp. 3-4. If some other case arose in which the evidence did show that a licensee deliberately contaminated someone, it is inconceivable that the NRC would fail to take action, including federal criminal prosecution, to punish the offender. *See* 42 U. S. C. §§ 2272-73.

The appellant cites no authority for the proposition that there is a constitutional right to punitive damages. Moreover, it is this Court's policy to avoid unnecessary adjudication of federal constitutional questions where independent state grounds support the decision below. *See City of Mesquite* v. *Aladdin's Castle, Inc., supra,* 102 S. Ct. at 1077.

B. It Was Unnecessary for the Tenth Circuit to Reach the Federal Preemption Issue Upon Which the Appellant Relies Here for Jurisdiction.

The Jurisdictional Statement here is fundamentally flawed. The appellant has sought to present questions for review here in a posture that erroneously suggests that the only action of the

court below was to reverse the punitive damage award, ignoring the first holding of the Tenth Circuit that Silkwood's exclusive remedy for personal injuries was under Oklahoma's worker's compensation laws. By virtue of this holding under state law, which is not presented here for review, the underlying basis for a punitive damage award no longer exists and any federal question presented is not substantial.

The court below correctly reversed the award of compensatory damages for personal injuries awarded to Silkwood because the exclusive remedy for such claims is provided under the Oklahoma worker's compensation laws. In fact, the same exclusivity applies to punitive damages as well as compensatory damages. The liability prescribed under the worker's compensation laws is ". . . exclusive and in place of all other liability of the employer and any of his employees, at common law or otherwise. . . ." 85 O. S. §§ 11-12, A. 63.

Moreover, in Oklahoma as in virtually all jurisdictions, there is no independent cause of action for punitive damages, they being only incidental or collateral to an underlying compensatory damage claim. *Gilbreath* v. *Phillips Petroleum Co.*, 526 F. Supp. 657, 659 (W. D. Okla. 1980). In the absence of compensatory damages, there can be no recovery of exemplary damages. *Brown* v. *Higby*, 191 Okla. 173, 127 P. 2d 195, 196 (1942). The only compensatory damage award which remains in this case, as it is presented to this Court, is the stipulated sum of $5,000 for Silkwood's personal property, which was removed from her apartment by Kerr-McGee during the decontamination process. It cannot seriously be contended that the contamination of this property, under circumstances unexplained by the plaintiff, could be a proper predicate for an award of $10,000,000 in punitive damages.

Oklahoma law requires that punitive damages must bear a reasonable relationship to the injuries sustained by the plaintiff "*and* the cause thereof." (Emphasis added). *Hobbs* v. *Wat-*

kins, 481 P. 2d 746, 754 (Okla. 1971). *See also Misco Leasing, Inc.* v. *Keller*, 490 F. 2d 545 (10th Cir. 1974); *Dearmore* v. *Gold*, 400 F. 2d 887 (10th Cir. 1968). The $10,000,000 award of punitive damages has *no* relationship, much less a reasonable relationship, to the compensatory award for property damage or its cause. Indeed, the appellant not only failed to prove how the property damage came about, but his counsel readily conceded that he had no explanation of the circumstances of the apartment's contamination:

> [W]e concede to the jury and concede to the Court that we can't satisfy the mechanism by which the plutonium got from the Cimarron Facility into Karen Silkwood's apartment and into her lungs, and we concede that point. . . . R. 3443.

This case was tried as a personal injury action. The complaint, the evidence, the instructions, and the rulings on the post-trial motions all point to the inescapable fact that the asserted basis for the punitive damage award here was the relationship between Kerr-McGee's alleged misconduct and the alleged personal injury of Silkwood, not the comparatively nominal damage to her personal property. *See, e.g.*, J. S. App. at 42a, 44a, 85a, 94a, 95a, 96a, 99a, 103a, 109a.[12] Since the only possible basis for a punitive damage claim, the claim for personal injuries, is barred, the punitive damage claim based thereon is likewise barred.

The federal preemption issue, although correctly decided by the Tenth Circuit, need not have been reached below as the

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[12] The court's affirmance of the property damage award of $5,000 was on the theory of strict liability and not on any wrongful act or omission by Kerr-McGee. J. S. App. 18a-21a. Indeed, the jury was instructed that recovery can be had under such a theory even though the defendant "has exercised the utmost care to prevent the harm to the plaintiff." J. S. App. 99a. Manifestly, the required fraud, malice or oppressive acts in relation to the property damage and its cause are not present.

punitive damage award could not stand in any event under controlling state law principles. *See, e.g., Flournoy* v. *Wiener,* 321 U. S. 253, 262 (1944). Plenary consideration of this case is clearly inappropriate where any decision would be purely academic or advisory in nature. *Cf. Rice* v. *Sioux City Memorial Park Cemetary,* 349 U. S. 70, 74 (1955) ("This Court does not sit to satisfy a scholarly interest in such issues."). This Court should decline the appellant's invitation to explore a tangential federal question not necessary to the summary affirmance of the decision below.

C. There Are Additional Non-Federal Grounds Which Preclude Any Punitive Damage Award.

There are two further independent grounds for denying punitive damages, which were not considered by the Tenth Circuit. Since the appellant is barred from recovering punitive damages on these alternate grounds, this Court should summarily affirm the decision below.

Compliance With Relevant AEC Regulations Precludes the Award of Punitive Damages.

The record is clear that Kerr-McGee was in compliance with AEC regulations as they related to Silkwood's alleged injury and property damage. The AEC conducted an exhaustive investigation, (Defendants' Exhibit 37, A. 1, *et seq.*) which conclusively establishes compliance by Kerr-McGee with AEC regulations relevant to Silkwood's claims. Where there has been substantial compliance with a pervasive regulatory scheme, punitive damages cannot be awarded, irrespective of preemption. The regulated party may not be condemned as a wanton wrongdoer for conforming to the standards set and the practices approved by the agency charged with the duty of regulating the conduct. *Nader* v. *Allegheny Airlines, Inc.,* 626 F. 2d 1031, 1035 (D. C. Cir. 1980).

Even if not preempted by statute, punitive damage awards are prohibited where they have the potential of interfering with a regulatory scheme and of creating a chilling effect, impairing the activities of parties otherwise subject to regulation. *International Brotherhood of Electrical Workers* v. *Foust*, 442 U. S. 42, 52 (1979) (setting aside a punitive award against a labor union for alleged breach of duty of fair representation); *see also Harrison* v. *Indiana Auto Shredders Co.*, 528 F. 2d 1107, 1123-26 (7th Cir. 1976) (where proper regulatory agency finds a licensee to be in compliance with license requirements, a court cannot go behind such a finding and award punitive damages based on the regulated conduct). Here Kerr-McGee's compliance with relevant AEC regulations is clear and precludes any recovery of punitive damages.

Punitive Damages May Not Be Awarded Without Evidence of Malice or Wanton Conduct.

Punitive damages are authorized in Oklahoma only where the very act causing the injury was actuated by or accompanied with evil intent or was the result of such gross negligence as to be the equivalent to evil intent. *See, e.g., Schuman* v. *Chatman*, 184 Okla. 224, 86 P. 2d 615, 618 (1938). At trial, the appellant did not prove or even attempt to prove any act causing damage and conceded that no such act or omission of Kerr-McGee could be identified. *E.g.*, R. 3443. *A fortiori*, there could not be any *proof of evil intent.* Even if the doctrine of federal preemption had not been applied, and even if Oklahoma's worker's compensation laws had not been held to be the exclusive remedy for personal injuries, the punitive damage award could not stand. Simply stated, the appellant may not concede a total failure of proof of the conduct underlying a claimed damage and recover a punitive award based solely on the fact of the damage.

CONCLUSION

For all of the foregoing reasons, this appeal should be dismissed or, in the alternative, the judgment below should be summarily affirmed.

Respectfully submitted,

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DEFENDANTS' EXHIBIT #37

RO INVESTIGATION REPORT NO. 74-09
DIRECTORATE OF REGULATORY OPERATIONS

REGION III

Subject: Kerr-McGee Nuclear Corporation Cimarron Plant
Crescent, Oklahoma
License No. SNM-1174 (Docket No. 70-1193)

An employee and her residence were found to be contaminated with plutonium on November 7, 1974.

Period of Investigation: November 8 to December 4, 1974

Investigators:

W. L. Fisher — 12/16/74 (Date)

J. A. Finn — 12/16/74 (Date)

K. R. Ridgway — 12/16/74 (Date)

J. H. Douglas — 12/16/74 (Date)

R. L. Sullivan — 12/16/74 (Date)

G. A. Phillip — 12·16·74 (Date)

Reviewed By:

J. A. Hind
Materials & Plant Protection Branch — 12/16/74 (Date)

J. M. Allan, Chief
Radiological and Environmental Protection Section — 12-16-74 (Date)

SCOPE OF INVESTIGATION

During the period November 8 to December 4, 1974, Regulatory Operations investigated the radiation protection and materials safeguards aspects of an incident involving contamination of a Kerr-McGee Nuclear Corporation employee (Individual A) and her apartment, and lesser contamination of her roommate (Individual B). The investigation was intended to discover the cause and extent of the contamination and to determine whether significant exposure resulted to employees. Individual A died in an automobile accident on November 13, 1974. The cause of this death is not within the jurisdiction of the AEC and therefore was not pursued during the investigation.

CONCLUSIONS

The investigation did not reveal exactly how the contamination occurred. However, several conclusions have been drawn from available evidence:

1. Individual A's personal contamination on November 5, 6, and 7 probably did not result from an accident or incident within the plant.

2. Two urine samples submitted by Individual A contained plutonium which was not present in the urine when it was excreted.

3. Individual A did not inhale a significant quantity of plutonium.

4. Individual A did ingest some plutonium on or about November 7, 1974.

5. Individual A's body organs and tissue contained a small amount of plutonium; less than one half the maximum permissible body burden.

6. Individuals B and C did not receive a biologically significant internal deposition of plutonium.

7. The quantity of plutonium released to the Edmond, Oklahoma, sewage treatment plant was probably insignificant.

8. No more than 0.0003 grams of plutonium were identified in the contamination of the individuals and their apartment.

9. No contamination was detected external to the apartment shared by Individua A and B and the bodies of these individuals and only a very small amount of contamination was found in individual A's automobile.

REASON FOR INVESTIGATION

Based upon telephone notification by the licensee on November 7, 1974, that: an employee was found to have contamination on portions of her body upon reporting to work that morning; bioassay samples she brought with her showed significant levels of radioactivity through a preliminary check; and, the apartment she shared with another female employee was found contaminated, Region III immediately initiated an investigation.

SUMMARY OF FACTS

At approximately 6:30 p.m. Tuesday, November 5, 1974, a Lab Analyst, hereafter referred to as Individual A, who was working in Glove Box No. 3 in the Metallography Laboratory, Room 135, of the licensee's plutonium plant checked her hands on a monitoring instrument mounted on the glove box and discovered that they were contaminated. She so informed another lab analyst who notified the plant Health Physics Office and requested assistance. Individual A was taken to the Health Physics Offices for decontamination and Room 135 was placed on respirator status, that is, respirators must be worn to enter, while two glove box gloves, which were found to be contaminated on their outside (handside) surfaces, were replaced. These gloves were subsequently tested by Kerr-McGee personnel and no leaks were found. Smear surveys of Room 135 showed no contamination. The air sample filter papers from the two air sample heads in the room showed essentially no airborne activity had been detected during the time Individual A had been in the room. By 9:00 p.m. Room 135 was taken off of respirator status and Individual A's decontamination completed. She returned to the laboratory, developed film and performed other miscellaneous paperwork but performed no work in the glove boxes. She stated she monitored herself as she left the plant at about 1:10 a.m. and detected no contamination. She was provided urine and fecal kits, specifically made up for her by a health physics technician. As a precautionary measure she was placed on a total collection bioassay program for the following five days because of the contamination occurrence.

On Wednesday, November 6, she arrived at the plant at about 7:50 a.m. and spent the next hour examining metallographic prints and performing paperwork. She performed no glovebox work that day. At 8:50 a.m. she prepared to leave the laboratory to attend a union negotiating meeting with plant management in her capacity as a representative of Local 5283 of the Oil Chemical and Atomic Workers Union. While monitoring herself as she exited, she detected contamination on her hands. A survey made by health physics personnel revealed some contamination on her hands, right forearm, and the right side of her neck and face. Her hands were successfully decontaminated and since the other spots were fixed contamination she was released by Health Physics to attend the meeting

with the understanding she would report back to Health Physics before going home.

She reported back to the Health Physics Office at approximately 4:30 p.m., underwent further decontamination of the earlier identified fixed contamination and was released by the health physics technician when contamination had been reduced to less than 500 d/m (disintegrations per minute).

At her request a health physics technician checked her locker at the plutonium plant and her personal auto and no contamination was found. Prior to leaving the plant, she was instructed to report to the Health Physics Office the next morning for another nasal smear before going into the laboratory to work.

On Thursday, November 7, she reported to the Health Physics Office at about 7:30 a.m. bringing with her a urine kit containing four urine samples and one fecal kit. When a nasal smear was taken significant contamination levels were detected in and around her nose and lower levels of contamination were found on other parts of her person. For this reason, while she was undergoing decontamination, the bioassay samples were given a preliminary check on a wound counter and found to have high levels of activity. Her locker and automobile were again checked and essentially no contamination was found.

Following her decontamination on November 7, she was accompanied by Kerr-McGee Health Physics personnel to her apartment in Edmond, Oklahoma which she shared with another lab analyst, hereafter referred to as Individual B. A survey of the apartment revealed significant levels of contamination in the bathroom and kitchen and spots of lower level contamination in other rooms. No contamination was found outside the apartment.

Individual B, who was asleep in the apartment having worked from midnight to 8 a.m., was awakened and checked for contamination. Two areas of low level contamination were found on her person. Individuals A and B and the Health Physics personnel returned to the licensee's plant where Individual B was decontaminated and preparations were made to initiate decontamination of the apartment. Individuals A and B were placed on a bioassay sampling program by the licensee.

Decontamination of the apartment was begun November 7 and continued intermittently to December 2. Final surveys by the licensee on December 3, 1974, showed no contamination levels greater than 2 d/m per 100 square centimeters. Representatives of the State of Oklahoma Department of Health and Region III concurrently performed direct reading and smear surveys of the apartment on December 3, 1974. By letter dated

December 10, 1974, Region III advised the State of Oklahoma Department of Health that the Region III survey results showed contamination levels within the apartment are below those specified in an AEC guideline for the release of facilities and equipment for unrestricted use.

Two individuals who had visited the apartment during the period November 5-7 were subsequently checked. No contamination was found on either individual. One individual had visited the apartment on November 5 and the other, hereafter referred to as Individual C had spent the night of November 6 in the apartment. On November 9, Individuals A and B were seen by the licensee's medical consultant, and by a medical consultant retained by the Region office on this case. Arrangements were made for Individuals A, B and C to go to the Los Alamos Scientific Laboratory on November 11 for in vivo counting.

On November 12, the three individuals returned from Los Alamos. Individuals A and B returned to work on November 13 and were restricted from further radiation work by Kerr-McGee. Between 7 and 8 p.m. on November 13, Individual A died in an automobile accident. The State of Oklahoma Medical Examiner's Office certified the death as accidental and stated that the accident was in no way related to radiation exposure.

The data obtained through analysis of urine samples submitted to the Health Physics Office by Individual A, at about 8:00 a.m. on November 7 indicated a significant inhalation of plutonium might have occurred. A examination of health physics records for the plutonium plant for the period July 15-November 8 including all employee personnel bioassay data, air sample records, constant air monitor records, as well as smear and survey records and interviews with plant personnel provided no information regarding an occurrence to which an inhalation of plutonium of the magnitude indicated by Individual A's November 7 urine samples could be attributed.

The in vivo counts performed by Los Alamos Scientific Laboratory on November 11 revealed no detectable plutonium (i.e., less than the Minimum Detectable Activity of 8 nanocuries) in any of the three individuals. However, Individual A's lungs were found to contain about 0.3 nanocuries of Am-241. An examination of tissue and internal organs obtained through post-mortem of Individual A on November 14 revealed the presence of some plutonium, primarily in the lungs and liver.

Data obtained through analysis of urine samples submitted subsequent to November 7 indicate that a significant inhalation did not occur. This inconsistency, together with the whole body count data and the post-mortem examination, indicates that two urine samples (Appendix I, No. 25 and No. 27) contained activity that had been added to the samples. This investigation, however, did not establish how or by whom the activity was added.

An evaluation of the bioassay data indicates that Individual A did ingest some plutonium in the recent past. This investigation, however, did not establish how or when this occurred.

All of the bioassay data and in vivo count data relating to Individuals B and C showed that neither of them had received a biologically significant internal deposition of plutonium.

The total amount of plutonium found in personal and apartment contamination is estimated to have been less than 0.0003 grams.

An effort has been made to include all available information in this report. However some data, such as additional bioassay information, which was not available at the time this report was prepared will be furnished at a later date.

The Department of Health, State of Oklahoma was notified of the incident by the licensee on November 7, 1974 and representatives of that office participated in parts of this investigation.

Region III issued a news release on November 8 regarding the incident and provided information and responded to press inquiries during the ensuing investigation. The incident received wide coverage by all news media.

As a result of this investigation certain activities under License No. SNM-1174 appear to be in violation of AEC requirements as indicated below. A violation considered to be of Category III severity is as follows:

Condition No. 22 of AEC license SNM-1174 requires a urinalysis program. Atomic Energy Commission regulations, 10 CFR Part 20.401(c), require that ". . . . records of bio-assays . . . . shall be preserved . . . . ."

Contrary to the above, the voiding dates and identity of two highly significant urine samples are not known by the licensee. (See "Urine and Fecal Analyses.")

DETAILS

Personnel Contacted

Forty Kerr-McGee employees, including nineteen members of management, were contacted during the investigation. Others contacted included:

A representative of the Oil, Chemical and Atomic Workers International Union
An apartment building owner
An Oklahoma State Highway Patrol Trooper
A Ford dealer
The Oklahoma State Medical Examiner
Kerr-McGee Nuclear Corporation's medical consultant
Three representatives of the Department of Health, State of Oklahoma

Sources of Information

Information contained in this report was obtained through interviews, examination of records, observations, and independent measurements by the AEC.

Chronology of Events

On November 5, 1974, Individual A, a Laboratory Analyst, reported for work at the licensee's plutonium plant at 1:20 p.m. after having been absent from work during the period November 1-4, 1974. At that time she was presented with a reprimand by her supervisor for having taken a prescription drug, Tylenol 3, at work on October 31 without informing her supervisor as required by company policy.

Individual A proceeded to perform miscellaneous paperwork in the Metallography Lab, Room 135, while wearing a smock. At about 2:45 p.m., as Individual A and her supervisor monitored themselves as they were leaving the work area to take a break, the supervisor detected a contaminated shoe cover. They remained in the work area while the supervisor changed shoe covers and called the Health Physics Office. A health physics technician checked the laboratory floor and the supervisor's feet. At 3:15 p.m. Individual A and the supervisor left the laboratory to take a work break and in monitoring herself, she found no contamination on her person. She returned to the laboratory at about 3:30 p.m., performed some paperwork and labeling. At 3:45 p.m., she put on coveralls and lightweight plastic gloves which she taped to her wrists. She started working in the glove boxes, first grinding plutonium samples in glovebox No. 6. Later she polished samples and cleaned them ultrasonically in glovebox No. 3. At 5:30 p.m., Individual A checked her hands and arms and found no contamination. She removed her coveralls and took a break. At about 5:45 she returned to the laboratory, put on coveralls and performed more sample grinding in glovebox No. 6. She also performed more sample polishing and ultrasonic cleaning in glovebox No. 3. After performing some polishing work in glovebox No. 4, she returned to glovebox No. 3 for glovebox cleanup.

At about 6:30 or 6:45 p.m., she withdrew her hands from glove box No. 3 gloves and, as procedures required, checked her hands with a monitoring instrument mounted on the front exterior of the glovebox. She found them contaminated and called another lab analyst working in an adjacent laboratory room to obtain a health physics technician for assistance. Upon arrival, the Health Physics Technician found contamination up to 20,000 d/m* (disintegrations per minute) on the right sleeve and shoulder of her coveralls. A female safeguards clerk was called in to assist in surveying and decontaminating her. When changing coveralls, Individual A's left hand was found to be contaminated. Because of this, she put on a clean pair of gloves, which she did not remove until she entered the shower. A survey before showering revealed contamination on the left hand, right wrist, and upper arm, neck, face, and hair, the highest level being 10,000 d/m on the right wrist. Nose smears showed a maximum contamination level of 160 d/m. Nasal irrigation reduced this to a maximum of 3 d/m. During the course of irrigating her nostrils, Individual A informed the health physics technician her left nostril was blocked as a result of a broken nose she received as a child.

After showering and washing her hair, she was placed under a hair dryer for 30 to 45 minutes. A final survey revealed no contamination greater than 500 d/m. She was released to return to work.

A urine kit and a fecal kit were prepared for her use by a health physics technician and she was requested to begin a total collection program which was to last for the next five days. Between 9 and 10 p.m. these kits, which bore a label with her name and badge number, were placed on a shelf situated for this purpose in the hallway leading to the air lock through which all personnel must pass.

The extra kits were provided to Individual A so that she could begin a five day total collection program even though it was recognized that she probably had at least one urine kit at home, since she had earlier been placed on a weekly sampling schedule because of an occurrence on July 31, 1974. Additional information concerning that occurrence is provided elsewhere in this report.

When Individual A reported her contamination at 6:45 p.m., the filter papers in the two air sample heads in Room 135 were changed. The room was placed on respirator status, a routine precautionary measure which is taken while the room is checked to find and eliminate the source of the contamination. A health physics technician surveyed the room and found no contamination except on two of the three gloves in glovebox No. 3. The right glove read 5,000 d/m direct reading and the middle glove to which it was tied showed 2,000 d/m direct reading. The two gloves were found entwined which is normally done when an individual withdraws from them to prevent them from being pulled into the box by negative air pressure. Two shoe covers were found in the room, one reading 2000 d/m and the other about 500 d/m. With the assistance of a lab analyst, a health physics technician removed the two contaminated

*The licensee's decontamination release limit is 500 d/m. The AEC's decontamination release limits for facilities and equipment are given in Appendix F, pages 3-6.

gloves from the glove ports, stored them inside the glovebox and installed new gloves. The room was taken off respirator status at 9 p.m. and the air sample filter papers were changed again.

The following are the results of the air samples for the period 4:00 p.m. to midnight, November 5, 1974.

Time	Sampler No.	Concentration (microcuries per milliliter)
4:00 p.m.-6:45 p.m.	18	6×10^{-13}
	19	6×10^{-13}
6:45 p.m.-9:00 p.m.	18	3×10^{-12}
	19	$< 7 \times 10^{-13}$
9:00 p.m.-Midnight	18	5×10^{-13}
	19	5×10^{-13}

AEC regulations permit average airborne plutonium concentrations in occupied, restricted areas up to 2×10^{-12} microcuries per milliliter for forty hours in any period of seven consecutive days.

The gloves removed from glovebox 3 were visually examined by Kerr-McGee personnel and tested for holes by filling them with water on November 7. No holes were found. A Region III representative witnessed a second test of the gloves on November 12 and no holes were found. (Appendix A)

After being decontaminated, Individual A returned to Room 135 at 9 p.m., developed film and performed miscellaneous paperwork but did no more work in the gloveboxes. She stated she left work at 1:10 a.m., monitored herself as she exited and found no contamination.

On Wednesday, November 6, Individual A arrived at work at about 7:50 a.m. She put on a smock and performed miscellaneous paperwork. At 8:50 a.m. upon leaving the laboratory to attend a meeting, Individual A detected contamination on her hands. She went to the Health Physics Office for decontamination. Surveys performed there detected contamination levels up to several thousand d/m on her hands, right forearm and the right side of her neck and face. Her hands were successfully decontaminated and since the other spots were fixed contamination she was released by the health physics staff to attend a meeting which was being held in the office area in the Uranium Plant Building. The meeting, which she attended as a representative of Local 5283 of the Oil Chemical and Atomic Workers Union along with two other representatives, was a negotiating meeting with plant management.

The meeting recessed at noon and Individual A obtained permission from the health physics office to leave the site for lunch with the other union representatives. The meeting was resumed at about 1:30 p.m. and was concluded at 3:15 p.m. She and the other union representatives left the plant for further discussions and returned to the plant at 4:30 p.m.

Individual A then went to the Health Physics Office as she had been instructed that morning. She was surveyed with the assistance of a female employee and contamination up to 5,000 d/m was found on her right forearm, neck and face. A survey after decontamination indicated no contamination greater than 500 d/m. It was decided she should allow her skin and hair to dry more thoroughly and to survey her again. A final survey performed 30 minutes later showed no contamination greater than 500 d/m.

After decontamination, Individual A requested that a nasal smear be taken. The smear from one nostril showed about 170 d/m and the other showed about 30 d/m. A resmear of the higher reading nostril showed about 30 d/m. Since Individual A appeared to the health physics technician to be upset, he pursued the matter no further. The health physics technician, however, was concerned that the nose smears had shown anything, since she had not been in a radiation zone except for one hour that morning. He therefore, requested that she return to the Health Physics Office for another nasal smear when she reported for work the next morning. As she prepared to leave, Individual A requested a health physics technician survey her locker and her automobile. These surveys were made and essentially no contamination was detected. She left the plant at about 7 p.m.

On Thursday morning, November 7, Individual A reported to the Health Physics Office at about 7:30 a.m. She brought with her one fecal sample which was voided Wednesday night and four urine samples. Nasal smears of each nostril were taken and they showed 45,000 d/m. Direct surveys showed 40,000 d/m on and around her nose and 4,000 d/m on the back of her right hand and the thumb side of her left index finger. Nasal smears taken after nasal irrigation showed a maximum of 300 d/m. A survey of individual A's body showed contamination levels from 1,000 to 3,000 d/m on her hands, arms, chest, back, neck, and right ear. Showering reduced the contamination to less than 500 d/m. Nasal smears then showed a maximum of 150 d/m.

In view of the nasal smear results, the outside surfaces of the urine and fecal containers were smeared and found to be clean. The samples were taken to the plant's emergency building where a preliminary check of the samples was made using a sodium iodide scintillation wound counter. The four urine samples which were collected Tuesday night, Wednesday morning and night, and Thursday morning showed count rates of 170, 204, 137, and 139 counts per minute indicating significant activity in the samples. Since all count rates were similar, the samples were composited, and half of the combined sample or 500 ml was sent to the Kerr-McGee Technical Center for analysis. A 250-ml aliquot was subsequently sent to the AEC Health Services Laboratory for analysis. The remainder, about 250 ml was retained at the plant.

The fecal sample which was obtained Wednesday night, November 6, was also checked with the wound counter. Count rates of about 30,000 to 40,000 counts per minute were measured with the detector against the container. This sample was also sent to the Kerr-McGee Technical Center for analysis.

While Individual A was undergoing decontamination, surveys were made of the women's locker room, including the inside of her locker, the employee lunch room and her automobile. No contamination was found. Preparations were then made for health physics personnel to accompany Individual A to survey her apartment which she shared with another lab analyst, Individual B, who had worked from midnight to 8 a.m. that morning.

Upon arrival at the apartment at about 2 p.m., Individual B was awakened and surveyed. Two areas, hands and buttocks, were found to be contaminated to about 2,000 d/m.

The initial apartment survey revealed spotty contamination throughout the apartment, but primarily in the bathroom, kitchen and Individual A's bedroom. The highest contamination levels found were 100,000 d/m on the toilet seat and 400,000 d/m on a package of cheese and bologna in the refrigerator.

Individuals A and B and the health physics personnel returned to the plant where Individual B was decontaminated. A resurvey of Individual A at this time showed no contamination levels above 500 d/m. Nasal smears obtained from Individual A showed a maximum of 24 d/m.

Preparations were made for apartment decontamination which was begun later that day. From that time on, the two employees did not again occupy that apartment. They did, however, return to the apartment that evening to be present while the apartment's contents were surveyed and various contaminated items removed for storage at the Kerr-McGee Plant. Individual A did not re-enter the apartment but remained outside.

On November 6, Individual B had worked from midnight to 8 a.m. After leaving work, she had stopped to feed her horse in the stable where it was kept. During the day, she had attended classes at a nearby college. She also cleaned the apartment using two vacuum cleaners and washed some clothes. In the late afternoon or early evening she fell asleep on the couch and was awakened by Individuals A and C at about 10 p.m. Individuals A and C left the apartment and returned with pizza, beer and soft drinks which the three of them consumed while sitting on the living room floor.

Individual B prepared a ham sandwich using bread and meat from the refrigerator, placed it in a plastic bag and in turn into a paper bag along with some orange juice for her lunch at work. She left the apartment at about 11:30 p.m. to report for work at midnight. Upon arrival at the plant, she placed her lunch in the lunch room refrigerator.

Individual B stated that she left work at about 8 a.m. on November 7, stopped to feed her horse again and went immediately to the apartment. As she entered the apartment, she heard the telephone ringing and answered it using the instrument located in Individuals A's bedroom, Individuals A and B having separate bedrooms. Individual B stated that the telephone call was from Individual A informing her that plant personnel would be coming to the apartment to check for contamination. Individual B stated that she then went to the bathroom and from there into her bedroom where she disrobed and went to bed.

Individual A stated that she had collected the fecal sample, which she brought to the plant on November 7, immediately following her arrival at the apartment at about 7:30 p.m. on the evening of November 6. Individual C stated that when he arrived at the apartment at about 9 p.m. Individual A was talking on the telephone. When she finished her call, they awakened Individual B and went out for the pizza. Individual C stated that he and Individual A remained in the apartment after Individual B had departed for work. They listened to records and retired at about 1 or 2 a.m. Individual C said they arose the following morning about 6:30 a.m. Individual C went to his residence, changed clothes and went to work.

Individual A stated that she obtained a urine sample on the morning of November 7 and spilled some of the contents of the container. She wiped off the container and bathroom floor with tissue which she disposed of in the commode. She also recalled having taken some bologna from the refrigerator with the intention of preparing a sandwich for her lunch. She carried the bologna into the bathroom, placed it on the closed commode top. While in the bathroom she recalled that she had part of her Tuesday, November 5, lunch still at work and decided not to make a sandwich. She then returned the bologna to the refrigerator. She stated that she went directly to the Health Physics Office upon her arrival at the plant on the morning of November 7.

Through initial surveys at the apartment on November 7, a health physics technician ascertained that the pizza box and the empty beverage containers which were found in the waste basket, were not contaminated. The refrigerator in the plant lunch room, which was checked on the morning of November 7, was found free of contamination. The automobiles owned by Individuals B and C were surveyed by Kerr-McGee Health Physics personnel on November 7 and no contamination was found.

At their request, the vehicles of two other employees were surveyed on November 7 since Individual A had ridden in them on November 6. They were found free of contamination.

During the evening of November 7, Individual C was requested to come to Individual A's apartment where he and his automobile were surveyed by

Kerr-McGee personnel. No contamination was found. A Kerr-McGee health physics technician accompanied Individual C to his residence and surveys performed there detected no contamination.

On November 8, Individual A was absent from work. She was, however, interviewed by AEC representatives on that date. During this interview she requested that both she and her automobile be surveyed (See Appendix B). Individual A provided assurances that the total collection bioassay program was being continued. At the conclusion of the interview she provided four urine samples which she stated she had collected during the night of November 7 and on November 8. Individual A also stated that there were two urine samples in her locker at the plant and provided the locker key. These samples were obtained from the locker and sent to the Kerr-McGee Technical Center for analysis. During a subsequent partial interview with Individual A on November 13, she identified the larger of the two samples taken from her locker as having been collected during the week of October 27 - November 2. She stated the smaller sample had been collected while at the plant on November 7.

On November 9 Individuals A and B were seen by the licensee's medical consultant and an AEC medical consultant, who was retained by Region III for this case. Arrangements were made for Individuals A, B and C to be in vivo counted at the Los Alamos Scientific Laboratory. The three individuals accompanied by the Licensee's medical consultant departed for Los Alamos on November 10 and were counted on November 11 and 12. The data obtained from these counts are contained in Appendix C. Data obtained from earlier in vivo counting of these individuals by Helgeson Nuclear Services, Inc. are contained in Appendix D.. They returned to the Oklahoma City area on the night of November 12.

Individuals A and B reported for work on November 13 and were restricted from further radiation work. Individual A left the plant about 5 p.m. on November 13 and attended a union meeting in Crescent, Oklahoma. Upon the conclusion of the meeting at about 7 p.m., she left alone in her automobile. At 8:05 p.m. the Oklahoma State Highway Patrol received notification of an accident involving Individual A's car. The accident report indicated that 7.3 miles south of Crescent, Individual A's car, traveling south, had run off the east side of the highway and had traveled approximately 255 feet before hitting a concrete retaining wall. The Medical Examiner's report prepared by Dr. Robert E. Ringrose who examined the body at the Logan County Memorial Hospital, Guthrie, Oklahoma, on November 13 indicates the probable cause of death as multiple injuries.

Upon notification of the accident on November 13, Region III representatives and a Licensee representative, accompanied by a trooper of the Oklahoma State Highway Patrol performed surveys of Individual A's automobile and personal effects contained in it where it was impounded in Crescent.

Oklahoma. The accident scene, the Guthrie fire department ambulance and the personnel who had removed and transported the corpse were also surveyed. No contamination was found.

On November 14, a post mortem examination was performed at the State of Oklahoma Medical Examiner's Facility, Oklahoma City. Representatives from the AEC's Los Alamos Scientic Laboratory participated in the post mortem examination to obtain samples for analysis at the Los Alamos Scientific Laboratory. Analytical data are being furnished to the AEC medical consultant for inclusion in his evaluation.

Licensee personnel completed decontamination of the apartment on December 2. A report was prepared by the licensee containing data on the contamination found, the action taken and the results of smear surveys performed upon completion of the decontamination effort. A copy of this report is attached to this report as Appendix E.

On December 3 representatives of the State of Oklahoma Health Department and Region III concurrently performed direct reading and smear surveys of the apartment. By letter dated December 10, 1974, Region III advised the State of Oklahoma Health Department that the survey results showed contamination levels within the apartment are below those specified in an AEC guideline for the release of facilities for unrestricted use. A copy of the December 10 letter with the Region III survey results and the guideline are attached to this report as Appendix F.

Physical Protection

The Licensee's Physical Security Program was last inspected in September 1974. Two items of noncompliance which did not represent significant defects in the program were identified. The licensee's response in a letter dated October 26, 1974, indicates corrective action has been initiated which should bring the licensee's physical protection program into full compliance with requirements. The contamination found in the employee's apartment could have been caused by less than 0.0003 grams of plutonium. No larger amount of plutonium was identified off-plant during this investigation.

July 31, 1974 Occurrence

Prior to August 7, 1974, Individual A was assigned to the Emission Spectrography Laboratory, Room 133. On July 31-August 1, 1974, she worked from 4:00 p.m. to 4:00 a.m. The two air sample filter papers from Room 133 for the 4:00 p.m. to midnight shift were found to have high activity counts when analyzed. Individual A along with two other

employees who were also working in Room 133 during part of that period of time were requested to submit urine and fecal samples for the next four days. Individual A submitted fecal samples for August 1 and 6. The first urine sample submitted was from an August 6 voiding.

On August 16, 1974, the licensee informed Region III by telephone of the July 31 high air samples and stated that autoradiographs of the two air sample filter papers showed patterns not expected for a typical air sample. Bioassay samples from the three employees involved did not indicate an uptake of plutonium. In addition, an in vivo count (lung) of Individual A made by Helgeson Nuclear Services, Inc., on August 1, 1974, showed no detectable plutonium 239 or Americium 241. The licensee stated he did not consider this a valid exposure. The Region III representative advised him that his evaluation would be reviewed during a subsequent inspection.

On October 10, 1974, the licensee telephoned Region III to state that results of urine samples submitted for August 13 and August 25 had just been received. These results indicated possible uptake of plutonium. On the basis of the August 13 and August 25 sample results, the licensee submitted a report to the Commission dated October 16, 1974, which is attached to this report as Appendix G. Individual A is identified in the licensee's report as Employee A.

In that report the licensee stated: "The high-count air sample papers were alpha autoradiographed and the resulting photograph showed a pattern not expected for a typical air sample." A copy of that photograph was obtained and is attached to this report as Appendix H.

Bioassay sample data for Individual A for this period is as follows:

Date	Sample	dpm per Sample	Quantity of Sample
8/1/74	Fecal	0.5	148 grams
8/6/74	Fecal	< 0.3	214 grams
8/6/74	Urine	0.4	1000 ml
8/13/74	Urine	3.5	1100 ml
8/25/74	Urine	5.0	700 ml
9/12/74	Urine	< 0.1	800 ml
10/8/74	Urine	< 0.1	900 ml

Results on the urine samples submitted on September 12 and October 8 were received by the licensee subsequent to his submission of the October 16 report to the Commission. These samples as indicated above showed less than 0.1 disintegrations per minute per sample.

Decontamination Facilities and Methods

Personal decontamination at the plutonium plant is performed in a room adjoining the first aid room. Facilities include a sink, a bathtub with shower, and a respirator dryer which can also be used as a hair dryer.

If contamination is not removable by normal washing with soap and water, further decontamination is performed using Clorox and Tide. Potassium permanganate is available if needed for extremely persistent contamination.

Decontamination wastes flow to holdup tanks, which are sampled for analysis before discharge to the sanitary lagoon.

Kerr-McGee Radiochemical Analytical Capability

The Kerr-McGee Technical Center is responsible for analyzing urine and fecal samples for uranium and plutonium. The Kerr-McGee employee responsible for the program is a Ph.D radiochemist. The program was established during the spring of 1972.

Plutonium analysis is based on a paper entitled "Determination of Plutonium in the Environment by Extraction and Liquid Scintillation Counting" by J. P. Ghysels in Industries Atomiques and Spaciales, 1 (1972). Additional alpha liquid scintillation counting techniques are based on work done by J. L. McDowall at ORNL. The resultant procedures yield a chemical recovery of 98.5% ± 1.5%. Greater than a two thousandfold separation from the other actinides is obtained. The alpha detection limit is about 0.3 ± 0.13 d/m/l. Standardization is based on plutonium 239 reference sources (238-Pu + 241-Am < 1%, 240-Pu < 4%) obtained from Amersham Searle.

Before extraction, the ashed solids are acidified and filtered, resulting in liquid and solid fractions. The Kerr-McGee radiochemist stated, concerning oxides, the plutonium in the solid fraction would consist of material that had been fired at a temperature in excess of 700°C for at least one hour. Plutonium in the liquid fraction would consist of material that had been fired at a temperature of less than 500°C for at least one hour. Plutonium fired between 500 and 700°C would appear in both fractions. Plutonium in any other form is expected to be solubilized by the wet ashing procedure.

As stated previously, bioassay samples are normally counted by liquid scintillation. Other counting systems at the Technical Center which may be employed are a low background, gas flow, proporational counting system or a 1,024 channel analyzer coupled with either a 400 mm² surface barrier or NaI scintillation detector.

Urine and Fecal Analyses

Appendix I contains results of urine and fecal analyses performed for Individual A from the beginning of her employment at Kerr-McGee in

August 1972 until her death on November 13, 1974. During the period November 5 through November 13 she was on a total collection program.

Analytical differences among the participating laboratories cause minor difficulties in evaluating the bioassay data. For example Kerr-McGee and United States Testing report total plutonium, while Los Alamos reports Pu-238 and Pu-239 (the latter presumably including Pu-240), and the AEC Health Services Laboratory reports Pu-239/240 and Pu-238.

Where possible, Los Alamos and the Health Services Laboratory analyzed for Am-241 as well as plutonium. In some cases, samples having very small plutonium concentrations were not analyzed for americium, whose smaller concentration would have been difficult or impossible to measure.

The licensee was unable to identify voiding dates for sample Nos. 20, 22, and 23. Further, identity of the latter two samples was lost such that the analytical results cannot be assigned with certainty to the proper sample. The licensee, whose AEC license requires a urinalysis program, is therefore in violation of 10 CFR Part 20.401(c), which requires that records of bioassays be preserved.

Appendix J contains results of urine and fecal analyses performed for Individual B from the beginning of her employment at Kerr-McGee through November 1974.

Appendix K contains results of urine and fecal analyses performed for Individual C while employed by Kerr-McGee from August 1969 to September 1974, and during November 1974 as a result of the incident under investigation.

Isotopic ratios found in fecal and urine samples are compared in Appendix L with ratios found in other samples. Good agreement of Pu-239 to Pu-238 ratios was found. Except for two urine samples submitted by Individual A, (Appendix I, Nos 25 and 27) Pu-239 to Am-241 ratios agreed reasonably well. The two urine samples submitted by Individual A contained a higher percentage of Am-241.

Kerr-McGee Health Physics Records

A thorough audit of health physics records covering the period July 15 through November 22, 1974, revealed no plant conditions that could have caused a significant intake of plutonium. More than 3,600 pages of record material, outlined in Appendix M, were reviewed. Except for the instance described in the section of this report on Urine and Fecal Analyses, these records effectively document radiological conditions in the plant and the effect of such conditions on persons within the plant. Since the incident prompting this audit did not involve radioactive effluents, neither effluent nor environmental records were reviewed in depth during this investigation.

As evidenced by 1866 pages of "Air Sample Data Sheets" containing the results of about 40,000 routine and special air samples, the licensee conducts an extensive in-plant air sampling program. The air samplers, located throughout the plant, frequently reveal slight airborne radioactivity. This occurs less frequently in the laboratory areas in which Individuals A, B, and C worked than in some other portions of the plant.

With the exception of the July 31, 1974 occurrence, these records contain no evidence that significant airborne radioactivity occurred in the laboratory during the period reviewed.

"Air Sample Work Sheets" contain special calculations of airborne concentrations. Air sample data are used to determine MPC-hours of acutal or potential exposure. These records contain no evidence of airborne concentrations that could have caused significant exposure.

"Plutonium Special Air Test Report" forms document the taking of special air samples. The forms do not contain the air sample results, which are recorded on the "Air Sample Data Sheets," but do contain information regarding the need for the special air sample. These records show no conditions that might have caused significant exposure.

Health Physics monthly reports for the months July through November, 1974 contain no evidence of conditions that might have caused significant exposure.

Other records, including the "Contaminated Personnel or Personal Effects Report" and the "Shift Log" show evidence of minor contamination problems, but show no evidence of significant exposure.

Sewer System Survey

On November 14, samples for analysis by Kerr-McGee Technical Center and the AEC Health Services Laboratory were obtained from the Edmond, Oklahoma sewer system and sewage treatment plant by an RO:III representative, a Kerr-McGee representative, and a representative of the Edmond Sewer Department.

The sewer system serving the area of Edmond in which the apartment is located flows entirely by gravity to the treatment plant. The extended aeration Coffee Creek Plant, which opened during July 1974, accepts sewage from two independent systems having a total flow of about 1.8×10^6 gallons per day. The sewer network for the area in which the apartment is located accounts for about 6×10^5 gallons per day. Processing time is about two hours. Plant effluent, consisting of a clarified liquid, discharges into Coffee Creek. Solids generated at the plant are released to a settling pond at specified intervals. No solid material leaves the plant.

The following samples were taken: (1) sewer line approximately 400 feet downstream of the apartment (first access point); (2) lift station at the treatment plant; (3) settling pond at the treatment plant; (4) final clarification pond at the treatment plant; and (5) Coffee Creek approximately one quarter mile downstream of the plant discharge point.

Samples (3) and (5) were about half liquid and half solid. Samples (1) and (2) contained small amounts of suspended solids. Sample (4) was clear liquid.

In addition to the above samples, liquid samples were obtained on November 12 from the apartment bathroom sink trap and kitchen sink trap. The samples were taken by Kerr-McGee employees with a RO:III representative present. Also on November 8, the liquid in the toilet bowl was collected by Kerr-McGee employees. On November 14, an RO:III representative obtained a sample of this liquid.

Analysis of the samples by the AEC Health Services Laboratory yielded the following results:

	d/m/ml(1)	
Sample	239 - 240 Pu	238 Pu
Sewer line	$3.9 \pm 0.3 \times 10^{-3}$	$3 \pm 1 \times 10^{-4}$
Lift Station	$2.4 \pm 0.3 \times 10^{-3}$	$5 \pm 2 \times 10^{-4}$
Settling Pond	$1.0 \pm 0.3 \times 10^{-3}$	$5.7 \pm 3 \times 10^{-4}$
Clarification pond	$9 \pm 2 \times 10^{-4}$	$2 \pm 2 \times 10^{-4}$
Coffee Creek	$3.9 \pm 0.7 \times 10^{-3}$	$8 \pm 3 \times 10^{-4}$
Bathroom sink trap	16.6 ± 0.9	2.02 ± 0.12
Kitchen sink trap	$6.8 \pm 0.18 \times 10^{-2}$	$7.6 \pm 0.4 \times 10^{-3}$
Toilet Bowl	$4.3 \pm 0.2 \times 10^{-1}$	$5.5 \pm 0.2 \times 10^{-2}$

(1) Total activity per sample. All solids put into solution.

The above data provide no evidence that significant amounts of radioactivity was released via or is present in the public sewer system.

Kerr-McGee Employee Lockers

A survey by Kerr-McGee health physics personnel on November 7, 1974, of the locker assigned to Individual A revealed no contamination. A survey of 106

employee lockers made by Kerr-McGee on November 14, 1974, revealed no contamination except 2000 d/m in a locker assigned to an employee not involved in the occurrence under investigation. The contamination was removed.

Apartment Surveys and Decontamination

Shortly after noon on November 7, 1974, Kerr-McGee Health Physics representatives made a survey of Apartment No. 2 at 908 North Washington, Edmond, Oklahoma. Later on the same day, more comprehensive survey and decontamination efforts were begun by Kerr-McGee. These efforts continued through December 2 and required a crew of 2 to 7 employees.

Surveys in the vicinity of the apartment showed no radioactivity outside the apartment. Included in the surveys were an adjacent laundry and the trash container used by the apartment complex. The highest levels of contamination were found in the bathroom and the kitchen. Only minor levels of contamination were found in other rooms.

The following major contamination levels were found:

	Location	(dpm)
Bathroom	Toilet Seat	100,000
	Sink	1,000 to 2,000
	Tub (2 spots)	2,000
	Mat	40,000
	Floor	20,000
Kitchen	Cabinet Top	20,000
	Inside Refrigerator	3,000
	Floor (max.)	20,000
	Counter Top	1,000
	Stove Sides	25,000
	Chicken Package	6,000
	Cheese Package*	600
	Cheese	1,500 - 2,500
	Bologna Package*	800 to 38,000
	Bologna	400 to 2,500
Bedroom Individual A	Pillow Cases	500 - 1,000
	Bed Sheets	500 - 2,000
Vacuum Cleaners	Canister Type	Nothing Detectable
	Small Cleaner	40 - 50
Ductwork	Filter	1,000
	Duct Wipes	8 - 10

* When initially surveyed while in the refrigerator, a wrapper containing both the bologna and cheese packages was found to be contaminated to about 400,000 dpm. The lower levels were measured after removal from the apartment.

Air samples were taken throughout decontamination activities. The air concentration on November 7, 1974, was 2.4×10^{-12} microcuries per milliliter. Full face respirators were worn on that date. Air concentrations on later dates were less than 4×10^{-13} microcuries per milliliter.

Contamination was removed by repeated scrubbing where possible. Items considered not decontaminable or difficult to survey were removed by Kerr-McGee for treatment as contaminated waste. Furniture removed included the sofa, tables, television set, bedding, refrigerator, and range. Carpeting was removed, as were a few tiles from the bathroom. About twelve fifty-five gallon drums of smaller articles were removed. These materials were taken to the Cimarron Facility pending final disposition.

The heating system ductwork was cleaned and filters were replaced. Each apartment has its own heating system.

Direct reading surveys and smear surveys were made continually during the entire period. Final direct reading surveys made by Kerr-McGee showed < 200 disintegrations per minute per probe area of 60 cm^2 (minimum dectectable). Of a total of about 1100 smear surveys, 140 showed positive results. The highest was 24 disintegrations per minute. Areas smeared ranged from 1,000 cm^2 to 10,000 cm^2. Details are in attached report from Kerr-McGee to the Oklahoma State Department of Health. (Appendix E)

On December 3, 1974, RO:III made radiation surveys of the apartment. All direct measurements were less than 300 disintegrations per minute per probe area (60 cm^2) (minimum detectable). Thirty-five smear samples were taken and counted at Argonne National Laboratory. Of these, only 4 showed positive results. The highest was 0.36 dpm per 100 cm^2. Sample results are in the December 10, 1974 letter from RO:III to the Oklahoma State Department of Health (Appendix F).

Resurvey of Articles Removed from The Apartment

On December 2, 1974, twelve 55-gallon drums of materials removed from the apartment were inspected and spot contamination surveys were made. Contaminated furniture was not resurveyed at this time. Several articles were obtained by Kerr-McGee to help in their investigation. Included in these were several vials. The caps of the vials were removed and the vials checked with a portable alpha survey meter; no contamination was detected. Portions of the bath mat and the toilet seat cover were retrieved by Kerr McGee to obtain radioactive material for analysis by Battelle-Northwest, a Kerr-McGee consultant. Spot survey checks made during the inspection revealed no radioactivity above that previously identified during the apartment surveys.

Handling of the drums and materials was done by Kerr-McGee Health Physics personnel, who wore protective clothing and full face respirators. A representative from Region III and a licensee consultant from Battelle-Northwest were present as observers. All other observers were Kerr-McGee personnel. A plastic tent for contamination control had previously been erected near the door in Room 123, the Fabrication Room. Observers stationed in the corridor were able to see through the door windows. Air samples taken during the operation were all less than MPC.

Exposure Evaluation

The results of bioassay analyses, lung and whole body (in vivo) counts, and analysis of tissues obtained post-mortem are being evaluated by a medical consultant to the AEC. Since all such data are not yet available, final conclusions cannot be drawn. However, the medical consultant has tentatively concluded that:

1. Individual A's body contained a small amount of plutonium, probably less than one half the maximum permissible body burden of forty nanocuries.

2. Plutonium concentrations found in urine samples submitted after 8:00 a.m. of November 7, 1974, appear to be consistent with preliminary post-mortem findings and with in vivo findings. (Appendices C and I)

3. Plutonium concentrations found in certain urine samples submitted from mid-October 1974 through 8:00 a.m. on November 7, 1974, do not appear to be consistent with preliminary post-mortem findings and with in vivo findings. (Appendix I, Nos. 22, 23, 25, and 27) These concentrations probably resulted from exogenous contamination. This conclusion is supported by the fact that plutonium-to-americium ratios in urine samples 25 and 27 is not consistent with ratios found post-mortem in body tissues.

No conclusions have been drawn concerning the source of plutonium found in fecal samples or the relationship of fecal, in vivo, and post-mortem data.

Bioassay analyses and in vivo counts have not indicated significant uptake of plutonium by either Individual B or Individual C. Since all data are not yet available, final conclusions cannot be drawn concerning the nature or extent of these exposures.

All bioassay, in vivo counting, and post-mortem sample data are being furnished to the AEC medical consultant for inclusion in his evaluation of the medical aspects of the case. When received, his report will be appended to this report as Appendix N.

Attachments:
Appendices A through M

APPENDIX A

Examination of Gloves Removed From Glove Box #3, Room 135

A survey of the gloves on glove box 3, Room 135, on November 5, 1974, showed direct readings of 5000 disintegrations per minute on the right glove and 2000 disintegrations per minute on the left glove. The gloves were replaced on swing shift, November 5. The removed gloves were placed in a bag and left in Glove Box No. 3.

On November 7, 1974, the gloves were visually inspected and were then tested, first by trapping air in each glove and then by filling with water to test for leaks. No leaks were detected.

On November 11, 1974, a Region III representative observed a repeat of the tests performed on November 7. No leaks were detected. The gloves appeared to be in very good condition.

APPENDIX B

Contamination Surveys

Individual A - At approximately 2:30 p.m. on November 8, 1974, an AEC inspector surveyed Individuals A's arms, face, neck, hair, and outer clothing for alpha contamination. None was found other than a trace (probably less than one disintegration per second) on her forearms and neck.

Surveys of Individual A's Car - On November 6, 1974, the licensee surveyed Individual A's car at her request. The survey revealed no contamination greater than the licensee's release limit of 500 disintegrations per minute. The survey was repeated on November 7. No contamination was found. At approximately 6:30 p.m. on November 8, an AEC inspector surveyed the car for alpha contamination. None was detected using a survey instrument having a sensitivity of about one disintegration persecond. A more sensitive survey made by the licensee on November 9 revealed slight removable contamination, the maximum being 0.7 disintegration per second found on some switches.

A survey by an AEC inspector of the wrecked car and contents at approximately 1:00 a.m. on November 14 revealed no contamination.

Individual C's Car and Apartment - A survey of Individual C's car and apartment by the licensee on November 7, 1974, revealed no contamination.

Individual B's Car - A survey of Individual B's car by the licensee on November 7, 1974, revealed no contamination.

Accident Site, Ambulance, etc. - A survey by AEC inspectors of the accident site, ambulance, ambulance crew, and sheets used to cover Individual A's body revealed no contamination.

APPENDIX C

In Vivo Counts At Los Alamos

Individual Counted	Date	Time of Day	Area Counted	Count Time (Min)	Nanocuries* Am	Pu	Comments
C	11/11/74	1017	Lungs	30	< MDA	< MDA	
	11/12/74	0930	Lungs	20	< MDA	< MDA	
	11/11/74	1429	Whole Body	30			Normal body activity
B	11/11/74	1104	Lung	30	< MDA	< MDA	
	11/12/74	0950	Lung	15	< MDA	< MDA	
	11/12/74	1008	Buttocks	5			No detectable activity
	11/12/74	1015	Hands	5			No detectable activity
	11/11/74	1500	Whole body	30			Normal body activity
A	11/11/74	1140	Lung	30	0.35±0.07	< MDA	
	11/12/74	1025	Lung	30	0.33±0.06	< MDA	
	11/12/74	1134	Left Chest	30	0.15±0.03	< MDA	
	11/12/74	1056	Right Chest	30	0.16±0.03	< MDA	
	11/12/74	1235	Left Abdomen	20			No detectable activity
	11/12/74	1212	Right Abdomen	30			No detectable activity
	11/12/74	1256	Pubic Area	5			No detectable activity
	11/11/74	1536	Whole body	30			Normal body activity

*Minimum Detectable Activity (MDA) for americium and plutonium were about 0.3 and 8 nanocuries, respectively.

APPENDIX D

In Vivo Counting By Helgeson Nuclear Services, Inc.

Individual Counted	Date	Nanocuries* Am	Pu
A	8/1/74	<0.05	<8
B	8/5/74	<0.06	<11
C	2/24/72	0.15	<6
	1/29/74	<0.06	<7

*"Less than" values are based on a 50% confidance level.

KERR-McGEE [illegible]
P.O. [illegible] • [illegible], OKLAHOMA [illegible]

December 4, 1974

Mr. Dale McHard
Occupational and Radiological Health Service
Oklahoma State Department of Health
N. E. 10th and Stonewall
Oklahoma City, Oklahoma 73105

Dear Mr. McHard:

This letter is notice that the apartment dwelling #2 located at 908 N. Washington, in Edmond, Oklahoma, has been cleansed free of plutonium contamination to the extent that only background levels of radioactivity are now detected.

Very truly yours,

Gerald J. Sinke, Coordinator
Radiation Health and Safety

GJS:mb

KERR-McGEE CORPORATION
INTERNAL CORRESPONDENCE

TO Morgan Moore DATE December 3, 1974

FROM A. W. Norwood SUBJECT Release of Edmond Apartment

This correspondence is notice that the apartment dwelling #2 located at 908 N. Washington, in Edmond, Oklahoma has been cleansed free of plutonium contamination to the extent that only background levels of radioactivity are now detected.

Listed below is documentation of the instrumentation used to make the release surveys:

1. The equipment used to obtain the smear survey data in this report consists of a five inch NAI crystal coated with zinc sulfide for alpha scintillation detection. The detector is powered by a Ludlum 2500 power supply. The equipment was calibrated daily with a Pu 239 (660 d/m) standard source. The equipment operates with a counting efficiency of 25% and with an average background of 0.2 d/m.

2. The direct reading surveys were made with an Eberline PRM-6 portable alpha survey instrument. This instrument has the ability to make positive detection of 200 d/m per 60 cm^2 above background.

Smears of the apartment were taken with 4.25 cm Whatman #1 filter paper. The areas smeared varied from 1,000 cm^2 to 1 sq. meter. Listed below is a summary of the smear results obtained:

Date	Location	Number of 0 d/m Smears	Level of Smears Above 0 d/m	Number of Smears Above 0 d/m	Total Smears
Nov. 20	Bathroom	9	4-8 d/m	1	10
	Front Bedroom	75	0 d/m	0	75
	Back Bedroom	75	0 d/m	0	75
Nov. 21	Bathroom	69	4-8 d/m	6	75
	Hall	34	4-8 d/m	2	36
Nov. 22	Bathroom	4	4-8 d/m	3	7
	Kitchen	99	4-24d/m	1	100
	Dining Room and Kitchen Closets	50	0 d/m	0	50

NUCLEAR DIVISION

Morgan Moore
December 3, 1974
Page 2

Date	Location	Number of 0 d/m Smears	Level of Smears Above 0 d/m	Number of Smears Above 0 d/m	Total Smear
Nov. 29	Dining Room	27	4-8 d/m	4	31
	Kitchen	27	4-12d/m	13	40
	Living Room	47	4 d/m	3	50
	Bathroom	40	4-12d/m	10	50
	Hall	17	4-8 d/m	3	20
	Front Bedroom	44	4-8 d/m	6	50
	Back Bedroom	46	4-12d/m	4	50
Dec. 2	Dining Room	42	4-8 d/m	8	50
	Kitchen	36	4-8 d/m	14	50
	Living Room	67	4-8 d/m	8	75
	Bathroom	41	4-12d/m	9	50
	Hall	21	4-8 d/m	4	25
	Front Bedroom	38	4-8 d/m	12	50
	Back Bedroom	41	4-12d/m	9	50
	Ventilation System	9	8 d/m	1	10
Dec. 3	All Areas	31	4-16d/m	19	50

On December 3, 1974, the apartment was turned over to representatives of AEC and the State Health Department for their inspection and approval. Direct readings show no detectable contamination in the apartment.
The smears taken by AEC will be sent to Argonne National Lab. for analysis and there will be some time delay before the results are received.

On December 4, 1974, smears with detectable levels that were taken on December 3 were recounted for ten(10) minutes. Smears which had shown 12 to 16 d/m on December 3 showed only 0.9 to 1.2 d on December 4. The natural Radon-Thoron daughter activity had decayed off leaving only 0.9 to 1.2 d/m on the smears.

A. W. Norwood

A. W. Norwood

AWN/rmj

UNITED STATES
ATOMIC ENERGY COMMISSION
DIRECTORATE OF REGULATORY OPERATIONS
REGION III
799 ROOSEVELT ROAD
GLEN ELLYN, ILLINOIS 60137

December 10, 1974

Mr. Dale J. McHard, Director
Occupational & Radiological Health
Division
State of Oklahoma
Department of Health
3400 North Eastern Avenue
Oklahoma City, Oklahoma 73105

Dear Mr. McHard:

On December 3, 1974, a representative of this office made radiation surveys of Apartment No. 2, 908 N. Washington Street, Edmond, Oklahoma, concurrently with surveys performed by a representative of your office.

Our direct radiation measurements were made with an Eberline Model PAC-3G alpha survey meter, Serial No. 931. The meter was calibrated with a plutonium calibration source, Serial No. P5733, provided by the Oklahoma State Health Department. All direct measurements were less than 300 dpm per probe area (60 cm^2).

Smear samples for removable contamination were made over areas of 1000 square centimeters. The samples were counted at Argonne National Laboratory. Only four samples were higher than the minimum detectable of 0.05 dpm per 100 cm^2. The highest was 0.36 dpm per 100 cm^2. Results are attached to this letter.

The results of this survey show that contamination levels within the apartment are below the levels specified in the attached AEC Guidelines for Decontamination of Facilities and Equipment Prior To Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material.

Sincerely yours,

James G. Keppler
Regional Director

Attachments:
As stated

APARTMENT SWEARS
TAKEN
DECEMBER 3, 1974

No.	Room	Location	dpm per 100 sq. c
1	Kitchen	Floor Near Refrigerator	*
2	Kitchen	Floor Near Refrigerator	*
3	Kitchen	Wall Near Refrigerator	*
4	Kitchen	Floor Near Range	0.17
5	Kitchen	Wall By Range	*
6	Kitchen	Sink	*
7	Kitchen	Sink Counter	*
8	Kitchen	Floor Near Sink	*
9	Kitchen	Cabinet Shelf	*
10	Kitchen	Dishwasher	*
11	Bathroom	Top of Toilet	*
12	Hall	Inside Door Bell Cover	*
13	Bathroom	Base of Toilet	*
14	Bathroom	Tub	0.36
15	Bathroom	Sink and Counter	*
16	Bathroom	Floor by Toilet	*
17	South Bedroom	Top of Dresser	*
18	South Bedroom	Doorknobs	*
19	South Bedroom	Floor Near Door	*
20	South Bedroom	Window Sill	*
21	South Bedroom	Wall	*
22	South Bedroom	Wall	*
23	South Bedroom	Closet	0.34
24	Front Porch		*
25	Back Porch		*
26	Living Room	Ceiling Near Air Return	*
27	Living Room	Window Sill	0.06
28	Living Room	Wall	*
29	Living Room	Wall	*
30	Hall	Wall	*
31	North Bedroom	Wall	*
32	North Bedroom	Knobs	*
33	Dining Room	Cabinet	*
34	Dining Room	Floor	*
35	Dining Room	Cabinet Shelf	*

* Less than 0.03 dpm per 100 cm^2.

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U. S. Atomic Energy Commission
Directorate of Licensing
Materials Branch
Washington, D.C. 20545

December, 1973

The instructions in this guide in conjunction with Tables I and II specify the radioactivity and radiation exposure rate limits which should be used in accomplishing the decontamination and survey of surfaces of premises and equipment prior to abandonment or release for unrestricted use. The limits in Tables I and II do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control will be considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Tables I or II prior to applying the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Tables I or II. A copy of the survey report shall be filed with the Director, Materials Branch, Directorate of Licensing, USAEC, Washington, D.C. 20545, and also the Director of the Regional Office of the Directorate of Regulatory Operations, USAEC, having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

Following review of the report, the AEC will consider visiting the facilities to confirm the survey.

SURFACE CONTAMINATION LEVELS[1]

TABLE I

ISOTOPE[2]	TOTAL[3]	REMOVABLE[3][4]
U-nat, U-235, U-238, Th-nat, Th-232, and associated decay products	10,000 dpm α/100 cm²	1,000 dpm α/100 cm²
Other isotopes which decay by alpha emission or by spontaneous fission	1,000 dpm α/100 cm²	100 dpm α/100 cm²
Beta-gamma emitters (isotopes with decay modes other than alpha emission or spontaneous fission)	0.4 mrad/hr at 1 cm[5]	1,000 dpm β-γ/100 cm²

TABLE II

ISOTOPE[2]	TOTAL[3]	REMOVABLE[3][4]
U-nat, U-235, U-238, Th-nat, Th-232, and associated decay products	Average[6]: 5,000 dpm α/100 cm² Maximum: 15,000 dpm α/100 cm²	1,000 dpm α/100 cm²
Other isotopes which decay by alpha emission or by spontaneous fission	Average[6]: 300 dpm α/100 cm² Maximum: 1,500 dpm α/100 cm²	100 dpm α/100 cm²
Beta-gamma emitters (isotopes with decay modes other than alpha emission or spontaneous fission)	Average[6]: 0.2 mrad/hr at 1 cm[5] Maximum: 1.0 mrad/hr at 1 cm[5]	1,000 dpm β-γ/100 cm²

---

(1) Either Table I or Table II may be used. For example, if all beta-gamma readings were less than 0.4 mrad/hr at 1 cm, Table I could be used; but if the maximum reading were 0.8 mrad/hr, material could be released under Table II provided the average was less than 0.2 mrad/hr.

(2) Where surface contamination by both alpha and beta-gamma emitting isotopes exists, the limits established for alpha and beta-gamma emitting isotopes shall apply independently.

(3) As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector and count rate meter for background, efficiency, and geometric factors associated with the instrumentation.

(4) The amount of removable radioactive material per 100 cm² of surface area shall be determined by wiping that area with dry filter or soft absorbent paper and with the application of moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. In determining removable contamination on objects of lesser surface area, the pertinent levels shall be reduced proportionally, and the entire surface shall be wiped.

(5) Measured through not more than 7 milligrams per square centimeter of total absorber.

(6) Measurements of total contamination shall not be averaged over more than 10 square meters. For objects of lesser surface area, the average shall be derived for each such object.

KERR-McGEE NUCLEAR CORPORATION
KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

October 16, 1974

Mr. Donald F. Knuth, Director
Directorate of Regulatory Operations
United States Atomic Energy Commission
Washington, D.C. 20545

Re: License #SNM-1174, Docket #70-1193

Dear Mr. Knuth:

Kerr-McGee Nuclear Corporation hereby reports that two employees were potentially exposed to airborne concentrations of insoluble plutonium 239 in excess of the applicable limits.

The potential exposure data is as follows:

Employee	Exposure Period	Average 40 Hr. Concentration
A	July 28 - Aug. 3, 1974	3.71×10^{-10} uCi/ml
B	July 28 - Aug. 3, 1974	1.59×10^{-10} uCi/ml

This possible exposure to these employees occurred during the 4:00 p.m. - midnight work shift on July 31, 1974 in room #133 of the laboratory section in the plutonium plant. Employee A worked over-time until 4:00 a.m. the next morning. She spent approximately 7 hours in the room before midnight, and nearly 4 hours after midnight.

Employee B spent 3 hours in the room before midnight. Another person (employee C) spent 10 minutes in the room and his exposure was estimated to be 8.8 MPC hours.

Employee A was working in glovebox Z, preparing samples for emission spectrography. Not once did employee A, B or employee C notice anything which could have caused an airborne problem. Self monitoring with instruments showed no contamination.

OCT 21 1974

The two air samples in the room were changed by a health physics technician shortly before midnight. These samples were later found to have high counts. (The air samples for the previous work shift were normal and the next samples, from midnight to 8:00 a.m., were also normal).

After the high samples were discovered on the 8:00 a.m. - 4:00 p.m. shift of 8/1/74, room 133 was posted as a respirator use area, and a careful survey was made for contamination. No contamination was found on box Z, on floors, walls, room exhaust filters or other equipment. A small area on top of glovebox Y had some contamination as did a flange to the vacuum systems above box Y. Decontamination was done. This contamination was not considered to be a contributor to the high air-count samples.

Employees A, B and C were placed on a daily bioassay sampling program for the next 4 days. These samples were analyzed for Pu by a procedure having a lower sensitivity of 0.5 dpm/l (for urine) and 0.5 dpm/kg (for feces). These are rapid procedures. The sample analytical results did not indicate an uptake of Pu. In addition, employee A was in-vivo lung counted later in the day on 8/1/74. The lung count results were negative for both 239 Pu and 241 Am.

The high-count air sample papers were alpha autoradiographed and the resulting photograph showed a pattern not expected for a typical air sample. The high count papers were then subjected to a solubility test and the contaminate was found to be 3.4% soluble and 96.6% insoluble.

The lack of evidence confirming exposure prompted the collectio of follow-up urine samples to be analyzed by a lengthy autoradiographic method giving a lower sensitivity of 0.1 dpm. Employee A submitted urine samples on 8/15/75 and 8/25/74. The results of these samples were received on 10/10/74. The results were 3.51 dpm/1100 ml. for the 8/15/74 sample and 4.98 dpm/700 ml. for the 8/25/74 sample.

Employee A is now on a weekly bioassay sampling program which will be sustained until enough data has been accumulated to assign a burden value or until three consecutive samples have results less than 1.0 dpm.

An initial estimate of intake for employee A from the air sample data is 2.6 nanocuries during the seven hour period in room 133; as follows:

The air concentration averaged 19,479 dpm with a volume of 27,187 liters (960 ft^3) resulting in a concentration of 0.7165 dpm/liter. A woman's light activity breathing rate is 19 liters/minute. In seven hours, 7,980 liters of air containing 5,718 dpm could have been breathed. This is equivalent to 2.6 nanocuries.

Since lung retention of insoluble particulates (50-500 day 1/2 life) is 12½% of the intake, the ultimate lung burden could hardly be more than 0.31 nanocuries. 16.0 nanocuries is the maximum permitted lung burden.

Employees B and C will be bioassay sampled further to determine if any internal deposition of plutonium is present.

Employee A is no longer working with unencapsulated plutonium materials. She now works in an area of very low exposure potential. This work restriction will remain in effect until we are certain that it is no longer necessary.

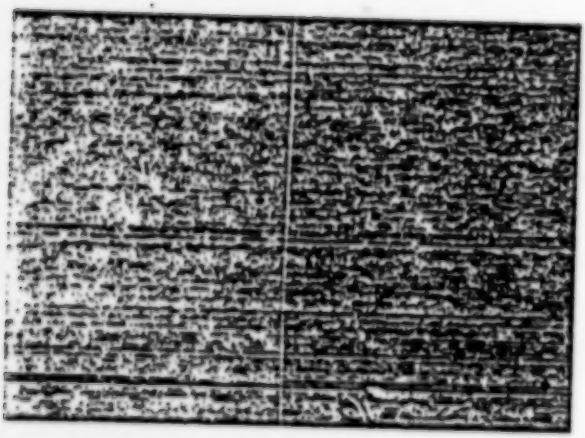
A copy of this report will be supplied to employees A and B in accordance with Part 19 regulations. In accordance with Part 20.405, the employees' identification and exposure data are listed on the enclosed appendix.

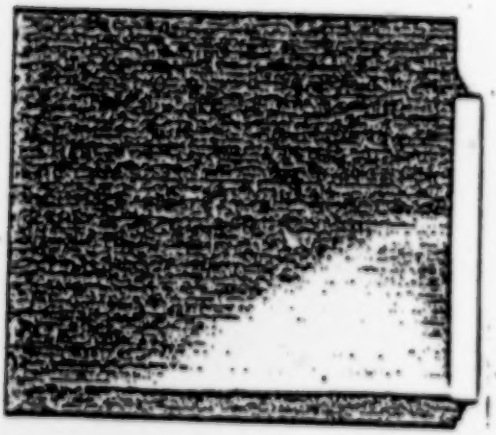
Sincerely yours,

W. J. Shelley, Director
Regulation & Control
Kerr-McGee Nuclear Corporation

WJS:ml

cc: Mr. James Keppler
Mr. Dale McHard

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No.	Basis	Solid Vol. or Wt.	Solid Initial	Solid Subsequent	Sediment Initial Vol.	Sediment Settling Time	Sediment Over Subsequent	Analysis Vol. or Wt.	Analysis In	Determination	Results
1	V		8/11/72			1hr	0-48			<0.1 ml/l hr	Plant Discharge
2	V		11/1/72			1hr	0-48			<0.1 ml/l hr	
3	V		2/12/73			1hr	0-48			0.32-1 ml/l hr	
4	V		3/7/73			1hr	0-48			<0.1 ml/l hr	
5	V		3/21/73			1hr	0-48			<0.1 ml/l hr	
6	V		3/31/73			1hr	0-48			<0.1 ml/l hr	
7	V		4/11/73			1hr	0-48			3.32-1 ml/1000 g hr	
8	V		4/25/73			1hr	0-48			<0.1 ml/l hr	
9	V		5/11/73			1hr	0-48			<0.1 ml/l hr	
10	V		10/16/73			1hr	0-48			<0.1 ml/l hr	
11	V		11/5/73			1hr	0-48			<0.1 ml/l hr	
12	V		5/13			1hr	0-48			<0.1 ml/l hr	
13	V	1000 ml	5/13			1hr	0-48	1000		<0.1 ml/1000 ml hr	
14	V	340 g	5/1			1hr	0-48	340		32-1 ml/340 g hr	
15	V	294 g	5/9			1hr	0-48	0-48		<0.1 ml/294 g hr	
16	V	5000 ml	5/5			1hr	0-48	0-48		48-1 ml/5000 ml hr	
17	V	2000 ml	5/11			1hr	0-48	1000		3.2 ml/1000 ml hr	

*100% volume reduction noted.

Annexure I (Page 2)

Sr. No.	Date	Data						Analysis			
		Vol. of Blank	Symbol	Sub-symbol	Symbol of Pt.	Tubing Diam.	Cross Section	Vol. of Blank	Dr.	Concentration	Remarks
18	9	700 ml	9/23			Dr	2.45		1007	3.0 dis/700 ml Pu	
19	9	800 ml	9/12			Dr	2.45		1007	< 0.1 dis/700 ml Pu	
20	9	900 ml	1			Dr	2.45		1007	< 0.1 dis/700 ml Pu	
21	9	950 ml	2420			Dr	2.45		1007	< 0.1 dis/700 ml Pu	
22	9	1000 ml	Between 20/13 & 20/20	Blank	None	Dr	2.45	1000 ml	1007	0.025 dis/1000 ml Pu	Dr. 21 and 22 samples possibly reversed.
23	9	1100 ml	9/5 20/21	9/5 20/21	None	Dr	2.45	1100 ml	1007	2.200 dis/1000 ml Pu	
24	9	425 ml	9/5 20/21	11/5*	Tank	Dr	2.45	425 ml	2.45	93.1 dis/425 ml Pu	*Removed from tanker
25	9	850 ml	9/5 2425	11/5	None	Dr	2.45	850 ml 850 ml	1007 1007		
26	9	50 g	2425	20/7	None	Dr	2.45	50 g	2.45		
27	9	2000 ml	2425+20	20/7	None	Dr	2.45	2000 ml 2000 ml	2.45 1007		

Appendix 1 (Page 39)

No.	Date	Vol. or Mass	Yielded	Sub-cultured	Yielded in	Yielding Spore.	Cross Linker	Vol. or Mass	Dx	Concentration	Remarks
29	0	150 ml	11/7	11/8	Broth	Bs	0-40	150 ml	0-40	1.0 kGy/150 ml Bs	Removed from Incubator.
30	0	1055 ml	11/7-8	11/8	Slime	Bs	0-40	1055 ml	0-40	0.2 kGy/150 ml Bs 1.3 kGy/305 ml Bs 0.3 kGy/305 ml Bs 0.4 kGy/95 ml Bs	
31	0	1535 ml	11/8-9	11/9	Slime	Bs	0-40	680 ml 305 ml 150 ml	0-40 0-40 0-40	1.0 to 4.0 kGy/680 ml Bs 80-1 kGy/305 ml Bs 0.3; 0.35-3 kGy/ml 230-240 Bs 1.3 ; 0.35-3 kGy/ml 230 Bs Not analyzed for 241-Bs	230-240 Bs=230-Bs-7.3
32	0	>215 g	11/9	11/9	Soup.	Bs	0-40	>215 g 24.4 g 44.3 g 41 g 40.8 g	0-40		
		>43g	11/9	11/9	Soup.	Bs	0-40	>43 g 23.0 g 20.3 g	0-40		

Gb
Vessel Alpha
Bs 1 Alpha

Gb Self	Gb Vessel	Bs Vessel
1.333	1.333	1.333 Paper Towel
1.333	1.333	1.333 Paper Towel
1.333	1.333	1.333 Paper Towel
1.333	1.333	1.333 Paper Towel
1.333	1.333	1.333 Paper Towel
1.333	1.333	1.333 Paper Towel

"Bs" cross contamination by pseudomonas and others not existing.

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APPENDIX I (Page 4)

No.	Sample Type	Data: Vol. or Mass	Data: Received	Data: Sub-mitted	Data: Yielded Al	Data: Yielding Isotr.	Data: Co-lumns	Analysed: Vol. or Mass	Analysed: By	Concentration	Remarks
34	U	100 ml	11/10 ?	11/13	None	Th	0-6	75 ml 100 ml	NRT NRL	0.17 d/m/75 ml Pu 3.3 ± 0.42-3 d/m/ml 239-240 Pu ≥ 2E-4 d/m/ml 239-Pu See enclosure for 241 Am	
35	U	275 ml	11/11*	11/11		Th	2-6	70 ml	LASL	0.13 d/m/70 ml 239-Pu	*Some or all precipitated
36	U	260 ml	11/11*	11/11		Th	2-6	70 ml	LASL	<0.03 d/m/70 ml 239-Pu	voided on 11/10.
37	U	325 ml	11/11*	11/11		Th	2-6	70 ml	LASL	0.03 d/m/70 ml 239-Pu	
38	U	130 ml	11/11*	11/11		Th	2-6	70 ml	LASL	0.04 d/m/70 ml 239-Pu	
39	U	890 ml	11/11	11/14		Th	LASL	70 ml	LASL	<0.03 d/m/70 ml 239-Pu	
28	U	425 ml	11/11	11/11		Th	LASL	70 ml	LASL	0.01 d/m/70 ml 239-Pu	
30	U	285 ml	11/12	11/13		Th	LASL	70 ml	LASL	<0.03 d/m/70 ml 239 Pu	
40	U	230 ml	11/12	11/13		Th	LASL	70 ml	LASL	<0.03 d/m/70 ml 239-Pu	
41	U	130 ml	11/12	11/13		Th	LASL	70 ml	LASL	0.02 d/m/70 ml 239-Pu	
42	U	422 ml	11/12	11/13		Th	LASL	70 ml	LASL	<0.03 d/m/70 ml 239-Pu	
43	F	70 g	11/11	11/11	LASL	Th	LASL	70 g	LASL	2.022 d/m/70 g Gamma Alpha 2.023 d/m/70 g 239-Pu 239-Pu+239-Pu = 3.9 6.005 d/m/70 g 239-Pu 239-Pu+241-Am = 17. 2.359 d/m/70 g 241 Am	
44	F	30 g	11/11	11/12	None	Th	LASL	30 g	LASL	3.020 d/m/30 g Gamma Alpha 6.005 d/m/30 g 239-Pu 239-Pu+239-Pu = 0.3 3.021 d/m/30 g 239-Pu 239-Pu+241-Am = 14 5.359 d/m/30 g 241-Am	

No.	Sample Type	Date Vol or Mass	Dated	Sub-planted	Method of Ag	Washing Meth.	Con-tainer	Date Vol. or Mass	By	Comments	Results
45	F	303 g	11/11	11/13	Sieve	No	Lab.	303 g	Lab.	1.30E dis/303 g Gross Alpha 1.60E dis/303 g 110-Pu 210-Pu/239-Pu = 1.7 1.02E dis/303 g 210-Pu 239-Pu/241-Am = 36 7.90E dis/303 g 241-Am	
46	F	303 g	11/11	11/13	Lab.	No	Lab.	303 g	Lab.	1.30E dis/303 g Gross Alpha 6.02E dis/303 g 110-Pu 210-Pu/239-Pu = 0.3 7.30E dis/303 g 210-Pu 239-Pu/241-Am = 31 1.02E dis/303 g 241-Am	
47	S	200 ml	11/11	11/13	Sieve	No	0-10	200 ml 100 ml	Lab. Lab.	<0.1 dis/200 ml Pu 1.0 ± 0.3E-4 dis/ml 210-240 Pu 2.3 ± 0.3E-4 dis/ml 210-Pu Not analyzed for 241-Am	
48	F	30.0 g	11/11 or 13	11/13	Sieve	No	0-10	30.0 g	Lab.	3.10E dis/30.0 g Pu	
49	S	440 ml	11/11 & 13	11/13	Sieve	No	0-10	200 ml 100 ml 100 ml	Lab. Lab. Lab.	<0.1 dis/200 ml Pu Composite Analysis 1±0.1E-4 dis/ml 210-240 Pu 1.5±0.1E-4 dis/ml 210-Pu Not analyzed for 241-Am 1±0.1E-4 dis/ml 210-240 Pu 1.5±0.1E-4 dis/ml 210-Pu Not analyzed for 241-Am	
50	S	1100 ml	11/11	11/13	0-10	Sieve	0-10	200 ml 200 ml 140 ml 200 ml	Lab. Lab. Lab. Lab.	<0.1 dis/200 ml Pu Composite Analysis 1±0.1E-4 dis/ml 210-240 Pu 1.5±0.1E-4 dis/ml 210-Pu Not analyzed for 241-Am 8±0.1E-4 dis/ml 210-240 Pu 2.3±0.3E-3 dis/ml 210-Pu Not analyzed for 241-Am 1±0.1E-4 dis/ml 210-240 Pu 1.5±0.1E-4 dis/ml 210-Pu Not analyzed for 241-Am	
51	F	30 g	Duplicate						Lab.	4.20E dis/30.0 g Pu	

A 43

SAMPLES	Data						Analyzed			
	Vol. or Mass	Voided	Submitted	Voided At	Voiding Descr.	Container	Vol. or Mass	By	Concentration	Remarks
9	1000 ml	1/1		Home	No	S-H	1000 ml	UUT	<0.1 d/m/1000 ml Pu	First Discovery
9	1000 ml	6/30		Home	No	S-H	1000 ml	UUT	<0.1 d/m/1000 ml Pu	
9	300 ml	11/8		Home	No	S-H	300 ml	S-H	1.0 d/m/300 ml Pu	
9	850 ml	11/9		Home	No	S-H	850 ml	S-H	5.0 d/m/850 ml Pu	
9	235 ml	11/11[AM]	11/11	Home	No	S-H	70 ml	LASL	<0.03 d/m/70 ml Pu-239	
9	250 ml	11/11[AM]	11/11	Home	No	S-H	70 ml	LASL	0.04 d/m/70 ml Pu-239	
9	445 ml	11/11[PM]	11/11	Home	No	S-H	70 ml	LASL	0.05 d/m/70 ml Pu-239	
9	380 ml	11/11[AM]	11/11	Home	No	S-H	70 ml	LASL	<0.03 d/m/70 ml Pu-239	
9	365 ml	11/12	11/12	LASL	No	LASL	70 ml	LASL	0.04 d/m/70 ml Pu-239	
F	72 g	11/11	11/11	LASL	No	LASL	72 g	LASL	2.383 d/m/72 g Gross Alpha 2.383 d/m/72 g Pu-239 Pu-239:Pu-238 = 6 : 1.682 d/m/72 g Pu-238 Pu-238:Am-241 = 1.882 d/m/72 g Am-241	
F	33.8 g	11/12	11/13?	Home	No	S-H	33.8 g	UUT	<3 d/m/33.8 g Pu	
9	1980 ml	11/12	11/13?	Home	No	S-H	1980 ml	UUT	<0.1 d/m/1980 ml Pu	
9	325 ml	11/12	11/12	Home	No	S-H	325 ml	UUT	0.0[illegible]-5 d/m/ml Pu-239/240 0.0[illegible]-0 d/m/ml Pu-238	
9		11/13			No	S-H		UUT	<0.1 d/m/700 ml Pu	
9	400 ml	11/14			No	S-H	400 ml	UUT	<0.3 d/m/400 ml Pu	

11 2000
Possibly voided on 11/10

Sample	Data						Analysis			
	Vol. or Mass	Yielded	Sub-mitted	Yielded At	Yielding Surv.	Container	Vol. or Mass	By	Concentration	Remarks
6		11/15			No	S-M		WHT		
6	1675 ml	11/16			No	S-M	675 ml 800 ml	S-M WHT	0.6 d/m/675 ml Pu $<$0.5 d/m/800 ml Pu	
7	43.7 g	11/17			No	S-M	43.7 g	WHT	3.3$\pm$1 d/m/43.7 g Pu	
8	1200 ml	11/17			No	S-M	1200 ml	WHT	$<$0.5 d/m/1200 ml Pu	
10	325 ml	11/18	11/21		No	S-M	600 ml 325 ml	WHT HAL	$<$0.5 d/m/600 ml Pu 3$\pm$3E-5 d/m/ml Pu-238/240 2$\pm$3E-5 d/m/ml Pu-238	
9	1390 ml	11/19	11/21		No	S-M	650 ml 840 ml	WHT HAL	$<$0.5 d/m/650 ml Pu 4$\pm$2E-5 d/m/ml Pu-238/240 3$\pm$1E-5 d/m/ml Pu-238	
9	580 ml	11/20	11/21		No	S-M	300 ml 480 ml	WHT HAL	$<$0.5 d/m/300 ml Pu 5$\pm$2E-5 d/m/ml Pu-238/240 2$\pm$1E-5 d/m/ml Pu-238	
7	41 g	11/18, 19, 20, or 21	11/21		No	S-M	41 g	HAL	1.3$\pm$0.3E-3 d/m/g Pu-238/240 1.5$\pm$0.3E-3 d/m/g Pu-238 9$\pm$1E-3 d/m/g Am-241	Pu-239/240: Pu-238-0.9$\pm$0.7 Pu-239/240: Am-241-15$\pm$1
6		11/26						WHT		
9		11/27						WHT		
9		11/28						WHT		
8		11/29						WHT		Final "daily" sample placed on "weekly" collection schedule

URINE AND FECAL ANALYSIS - INDIVIDUAL C

SAMPLE	Date* Vol. or Mass	Voided	Submitted	Analyzed Voided At	Voiding Hours	Container	Vol. or Mass	By	Concentration	Remarks
U	1100 ml	4/10/70							<0.1 d/m/1100 ml Pu	First Discovery
U	1200 ml	9/4/70							<0.1 d/m/1200 ml Pu	
U	700 ml	11/6/70							<0.1 d/m/700 ml Pu	
U	1100 ml	5/15/71							0.2 d/m/1100 ml Pu	
U	700 ml	6/22/71							<0.1 d/m/700 ml Pu	
U	1375 ml	9/20/71							<0.1 d/m/1375 ml Pu	
U	1300 ml	1/19/72							<0.1 d/m/1300 ml Pu	
U	1500 ml	4/25/72							<0.1 d/m/1500 ml Pu	
U	1500 ml	7/31/72							<0.1 d/m/1500 ml Pu	
U										Sample lost.
U	1300 ml	2/7/73							<0.1 d/m/1300 ml Pu	
U	1300 ml	6/20/73							<0.1 d/m/1300 ml Pu	
U	1500 ml	10/1/73							<0.1 d/m/1500 ml Pu	
U	1300 ml	11/20/73							<0.1 d/m/1300 ml Pu	
U	1500 ml	4/1							<0.1 d/m/1500 ml Pu	
U	1400 ml	6/19							<0.1 d/m/1400 ml Pu	
U	1500 ml	9/30							<0.1 d/m/1500 ml Pu	Final Discovery while [illegible] employed.

SAMPLE	Data						Analysed			
	Vol. or Mass	Voided	Sub-mitted	Voided At	Voiding Surv.	Con-tainer	Vol. or Mass	By	Concentration	Remarks
F	71 g	11/11	11/12	Home	No	LASL	71 g	LASL	<3.882 d/m/71 g Cesco Pu-239:Pu-238=6.7 Alpha 3.481 d/m/71 g Pu-239 0 d/m/71 g Pu-238 6 d/m/71 g Am-241	
U	140 ml	11/11*	11/11	Home	No	E-H	70 ml	LASL	<0.83 d/m/70 ml Pu-239	
U	350 ml	11/11*	11/11	Home	No	E-H	70 ml	LASL	<0.83 d/m/70 ml Pu-239	
U	141 ml	11/11*	11/11	Home	No	E-H	70 ml	LASL	<0.83 d/m/70 ml Pu-239	
U	310 ml	11/11*	11/11	Home	No	E-H	70 ml	LASL	<0.83 d/m/70 ml Pu-239	
U	325 ml	11/12	11/12	LASL	No	LASL	70 ml	LASL	<0.83 d/m/70 ml Pu-239	
U	185 ml	11/12	11/12	LASL	No	LASL	70 ml	LASL	<0.83 d/m/70 ml Pu-239	
U	190 ml	11/12	11/12	LASL	No	LASL	70 ml	LASL	<0.83 d/m/70 ml Pu-239	
U	335 ml	11/13	11/22	Home	No	E-H	335 ml	BNL	140.68-4 d/m/ml Pu-239/240 1.490.60-4 d/m/ml Pu-238	
F	109 g	11/13	11/22	Home	No	E-H	109 g	BNL	1.323 d/m/109 g Pu	
F	78.5 g	11/14	11/22	Home	No	E-H	78.5 g	BNL	1.1 d/m/78.5 g Pu	Final Disposal

*ossibly voided on 11/10.

APPENDIX L
ISOTOPIC RATIOS

Sample	Ref.*	Individual	Laboratory	Ratios Pu-239** / Pu-238	Ratios Pu-239** / Am-241	Remarks
Urine	I-25	A	HSL	7.9	6.0	
Urine	I-27	A	HSL	8.1 8.2	5.6 5.7	Second aliq analyzed.
Fecal	I-43	A	LASL	7.9	17	
Fecal	I-44	A	LASL	8.3	14	
Fecal	I-45	A	LASL	7.7	26	
Fecal	I-46	A	LASL	8.2	21	
Fecal	J-10	B	LASL	6.1	18	
Fecal	J-23	B	HSL	8.9	15	
Fecal	K-18	C	LASL	6.7	9	
Nose		-	HSL	7.6	16	
Kitchen Sink Trap		-	HSL	9.0	12	
Bathroom Sink Trap		-	HSL	8.2	18	
Toilet Bowl		-	HSL	7.8	23	
Glove Box Smear		-	HSL	8.3	11	
Nasal Smear (11/7)		A	LASL	8.1	16	

*Appendix - Sample Number
**Reported as Pu - 239/240 by HSL

APPENDIX H

Health Physics Records Reviewed During Investigation

"Air Sample Data Sheet"	1,866 pages
"Air Sample Work Sheet"	72 pages
"Plutonium Special Air Test Report"	994 pages
Health Physics Monthly Reports	59 pages
"Contamination Incident Report"	19 pages
"Contaminated Personnel or Personal Effects Report"	82 pages
"Special Radiation Survey Report"	2 pages
Bioassay Records	33 pages
"Shift Log"	529 pages
Miscellaneous	25 pages

RO INVESTIGATION REPORT NO. 74-09

DIRECTORATE OF REGULATORY OPERATIONS

REGION III

SUMMARY REPORT OF EVALUATION OF BIOMEDICAL ASPECTS OF THE KERR-McGEE PERSONNEL CONTAMINATION INCIDENT REPORTED NOVEMBER 7, 1974

Appendix N

Summary Report

To: Mr. James Allen
U.S. Nuclear Regulatory Commission
Region III

From: Hiel Wald, M.D., Medical Consultant

Date: 6 February 1975

Subject: Summary Report of Evaluation of Biomedical Aspects of the Kerr-McGee Personnel Contamination Incident Reported November 7, 1974

This is a report of the investigation of the biomedical aspects of an exposure incident at the Kerr-McGee plutonium facility in Cimarron, Oklahoma which was carried out in accordance with your telephone instructions of 10:30 AM, 8 November 1974. Individual A was the employee directly involved, but evaluations were also made for Individual B, her roommate, who was also a Kerr-McGee employee, and Individual C, a friend and former employee of the facility.

Pertinent Details of the Incident:

R.O. Investigation Report No. 74-09 provides a summary of the facts in this incident.

Medical Consultant Investigation:

In view of the unusual contamination history of the preceding several days, beginning on 5 November 74; the preliminary gross bioassay results which suggested a possible intake of 100 microcuries or more of mobile plutonium-239; and Individual A's reported unwillingness to return to work, collect excreta, or accept DTPA therapy without some guidance regarding her health status, arrangements were made to travel to Oklahoma City on 8 November 1974. Attempts to talk with the company medical consultant via telephone prior to departure in mid-afternoon were not successful. On arrival in Oklahoma City at 10:30 PM discussions were held with the AEC Regulatory Operations (R.O.) investigating team concerning the current status of their work. An interview was arranged with Individual A at 9:00 AM the next morning. At midnight the company medical consultant was reached by telephone. He had not yet seen the individual involved in the incident and was planning to arrive in Oklahoma City from Albuquerque at about 11:30 AM on 9 November. He gave approval to the planned meeting with Individual A, agreed to meet with me following his arrival, and asked me to inform Individual A that he would be available to her thereafter.

At 9:30 AM on 9 November Individual A was interviewed. At her request the legislative assistant to the Oil, Chemical and Atomic Workers Union, and Individual C, who accompanied her, remained in the room as did a member of the R.O. team who accompanied me. Individual A appeared tense and anxious, frequently seeking support and reassurance from Individual C and the Union staff member.

Pertinent historical information included a history of bronchial pneumonia and asthma from about 6 months to 15 years of age while living in Corpus Christi area of Texas. Treatment with gamma globulin seemed to be helpful. Then the asthma gradually disappeared but milder episodes of hay fever persisted. An old left nasal fracture resulted in unilateral chronically impaired breathing.

More recently, about October 1973, Individual A had a lung infection for which diagnostic chest x-rays were performed. She recovered by summer. About October 1974 a lung infection recurred lasting about 2 to 4 weeks, with diagnostic chest x-rays performed about 2 weeks ago. She was under the treatment of a physician in Oklahoma City. An additional observation was of hypertension for which he had given her some relaxant medication. This was discontinued on November 5th because of some side effects interfering with her work. She showed me a container with several types of capsules and pills including one she identified as Tylenol no. 3 (an analgesic containing acetaminophen, 300 mg. and codeine phosphate, 30 mg.). She was a cigarette smoker, using about a pack a day.

Individual A appeared intelligent and had completed 2 years of college training aimed at medical technology when she stopped for marriage and 3 children. Following dissolution of the marriage she moved to Oklahoma City about 3 years ago and began working at Kerr-McGee as a technician.

Individual A stated that she was concerned by the plutonium contamination findings and the repeated decontamination procedures which began on 5 November. She also felt that the company's response to the incident by having legal counsel take a deposition from her more promptly than they provided what she considered knowledgeable medical counsel was not helpful. By the morning of November 8th, therefore, she decided not to report to work until she had received such knowledgeable guidance concerning her health status. She was informed of the company medical consultant's expected arrival and agreed to meet with him in the early afternoon.

Discussions were then held with the Kerr-McGee medical consultant and their Coordinator of Radiation Health and Safety in the course of which arrangements were confirmed for whole body and chest counting as well as additional bioassay sampling to be carried out at Los Alamos Scientific Laboratory for Individuals A and C. Individual B was then interviewed by the Kerr-McGee medical consultant and me. In view of her concerns about the contamination of the apartment she shared with Individual A it was decided to included her in the in-vivo counting arrangement. Individuals A and C then returned along with several members of the Oil, Chemical and

Atomic Workers Union. Following general discussion aimed at clarifying the health issues involved and the appropriate diagnostic procedures, the Kerr-McGee medical consultant arranged for appropriate clinical laboratory and x-ray examinations at a local hospital that afternoon. It was also planned by him to administer one dose of DTPA to Individual A at that time. He had indicated that this was to have been given on November 8th at a clinic near the plant but Individual A had not reported for work that day.

Following departure of Individuals A, B and C and their associates, discussion was held with the Kerr-McGee medical consultant concerning the Kerr-McGee program for responding to personnel exposure incidents. He had indicated to the company that the relative isolation of the plant and the nature of the work there justified an in-vivo counting facility in the vicinity to provide quick resolution of problems like this one. However, he noted that it took many years even to develop the capability to do bioassay analyses at a nearby research center of the company. Regarding medical care, he indicated that the physician who operates a clinic in the plant's vicinity served adequately as a source of primary medical care, supported by the consultant's availability to provide technical aid when needed. The local physician was to have taken the AEC-sponsored short course in Medical Management of Radiation Accidents. The Kerr-McGee medical consultant was unable to explain why the local physician was not involved in our discussions with Individuals A, B and C or with each other. He indicated that his delay in seeing Individual A was due to her not having reported to work on November 5th as requested.

Biomedical Evaluations:

My further participation in the biomedical investigation and evaluation of results included continuing discussions with the Kerr-McGee medical consultant; the leader of the Health Division at Los Alamos Scientific Laboratory, and associated radiochemistry personnel; and personnel of Regulatory Operations staff.

Individual A:

In this individual, the evaluation of the magnitude of exposure and of any resultant body burden involved examinations of five sets of data. These are: A., the information obtained by monitoring the home and work environment of the individual (Appendices A and B), B., the results of urine and fecal excretion bioassays (Appendix I), C., the results of the in-vivo internal radioactivity measurements (Appendices C and D), D., the measurements obtained from radiochemical analyses of tissues and organs obtained at autopsy (Attachment A to this report), and E., the isotopic ratios of various samples (Appendix L and Attachment A).

A. Environmental Measurements:

Beginning with the first contamination episode involving Individual A on the evening of November 5th, 1974, smears and air samples from her work room did not indicate airborne activity. Her automobile showed only slight contamination of some switches at a maximum of .07 dps.

In her apartment the air concentration on November 7th was 2.4×10^{-12} microcuries per milliliter, just slightly above the level of 2×10^{-12} microcuries per milliliter which is permitted by AEC regulations for average airborne plutonium concentrations in occupied restricted areas for 40 hours in any period of 7 consecutive days. No more than 0.0003 grams of plutonium were identified in the contamination of the Individuals or their apartment.

B. Bioassay Data:

1. Urine - Individual A showed no urinary plutonium above background on 12 bioassays performed between August, 1972 and May, 1974. Following a possible small inhalation exposure on 31 July 1974, the urinary bioassays showed a gradual increase in activity, reaching a peak of 5.0 dpm/700ml. on the 25th of August and subsiding to baseline levels in samples of September 12th and October 8th.

The next two samples, I-22 and I-23, collected between October 15th and October 31st at home, showed levels 4 orders of magnitude above baseline. Sample I-24, collected at work in the same time period and left in Individual A's locker, was less than 1 dpm. Then I-25 and I-27, collected in the next week at home, were again 4 to 5 orders of magnitude higher. The remaining urine samples showed a return to fractional dpm values in a steadily descending order.

2. Feces - The samples collected shortly after the exposure incident of July 31st showed no difference in plutonium activity from that collected in the previous year. The remaining samples were collected beginning on November 6th in the course of the investigation of the recent contamination incident. Beginning at plutonium levels about 7 orders of magnitude above background, they showed a rapid fall with time over the following 7 days before Individual A's death.

C. In-Vivo Count Data:

In-vivo counting was carried out on Individual A on the 11th and 12th of November, 1974 at Los Alamos Scientific Laboratory. Their results are presented in Appendix C of the investigation report. Americium was detected equally in both sides of the chest, while plutonium was below the detection limit. Extrapolation from the americium level, using the isotopic distribution of a nasal smear as being representative of the inhaled material, resulted in estimation of 6 nCi of plutonium and .34 nCi of americium.

D. Post-Mortum Tissue Analyses:

Following the death of Individual A on 13 November 1974, an autopsy was performed. Tissues were removed to Los Alamos Scientific Laboratory for radiochemical analysis. The results of the tissue analyses, as summarized in the Los Alamos Scientific Laboratory report on Table 4.1 and Table 4.2, and their Appendix A summarizing all of the tissue data are appended as Attachment A to this report. It will be noted that the

fecal sample collected within the large intestine showed very similar activities to those obtained from pre-mortum fecal samples on November 12th and 13th. It should also be noted that the lung parenchyman contained at least 5 times as much activity as did the tracheo-bronchial lymph nodes.

The estimated organ burdens for plutonium are 3.6 nCi in liver, 5 nCi in lung, and less than 0.2 nCi in the bone. Since these are the major areas of plutonium deposition in the body, the Los Alamos Scientific Laboratory report concluded that the total plutonium body burden was under 10 nCi or less than 25 percent of the maximum permissible body burden for occupational exposure (40 nCi). The low value in the bone, and the relatively low value in the tracheo-bronchial lymph nodes compared to that in the lungs, suggested to Los Alamos Scientific Laboratory personnal that the major portion of the plutonium exposure was of recent origin, probably less than 30 days prior to death. The Los Alamos Scientific Laboratory report pointed out that because of the small sample size analyzed thus far and the resulting extrapolation uncertainties, the results must be used cautiously.

E. Isotopic Ratios:

Isotopic ratios were calculated from the results of the radiochemical analyses of environmental samples, excreta and post-mortum tissue samples. Ratios examined were those of plutonium-239 (plutonium-239/240 in HSL analyses) to plutonium-238; and plutonium-239 to americium-241.

The plutonium-239 to 238 ratio ranged from 5.9 to 10.0 with a mean of 7.9. There were no systematic deviations from the mean either by type of sample analyzed or by laboratory performing the analysis.

In general, the plutonium to americium ratios showed a greater range. Environmental samples, nasal smear and fecal samples had an average ratio of 16 with a range from 11 to 26. Samples collected at autopsy showed ratios of 16 for intestinal feces, 32 for liver and 19 for lung.

Isotopic ratios could be determined in two of the urine samples, I-25 and I-27, both of which had high activity levels. The ratios were 5.7 and 6.0.

Discussion and Conclusions:

1. The environmental levels do not suggest a high likelihood of the acquisition of a internal body burden of plutonium exceeding the occupational permissible limit by orders of magnitude, as the initial urine and fecal counts associated with this incident (I-26, I-27) suggested.

2. The results of in-vivo counting and tissue analysis are in reasonably good agreement as to magnitude of internal contamination, i.e. less than 10 nCi or 25 percent of the occupational "permissible body burden".

3. The plutonium-239 to 238 ratios of all samples are in general agreement. The plutonium-americium ratios of nasal smears, fecal samples, tissues and samples of home and work environment are also in reasonably good agreement. The fecal and urinary radioactivity levels after 7 November and the autopsy findings are compatible with the ingestion and inhalation of radioactive material a short time earlier than that date. These data suggest that the environmental contamination, the intake, the internal deposition and the fecal excretion could all have involved the same radioactive material. The fact that the Pu-Am isotopic ratios in the only two urine samples in which the analysis could be obtained are 5.7 and 6.0, could reflect a different contaminant and/or the body's greater facility for renal excretion of americium compared with plutonium.

4. Analyses of urine samples I-22, I-23, I-25 and I-27 gave results which are not in accord with the above mentioned internally consistent data. Discordant findings related to the samples include the following:

a. The high levels of activity in urine samples I-22 and 23 preceded the detection of any personal contamination of Individual A when monitored at her work place.

b. The one sample, I-24, which was apparently collected and kept at the plant has an activity level 4 orders of magnitude below the others mentioned. Such a variation in the excretion of plutonium and americium from high level to low level to high level over a few days is biologically unlikely.

c. It is biologically unlikely that the small body burden of a comparatively insoluble plutonium compound measured by in-vivo counting and in post-mortum tissue could have been so much larger 4 or 6 days earlier as to result in the high level of radioactivity seen in sample I-27.

5. Based on the above findings, it is inferred that activity found in urine samples I-22, I-23, I-25, and I-27 represents exogenous contamination and that remaining bioassay, environmental, in-vivo counting and post-mortum tissue findings are the result of a recent intake of Pu-Am material resulting in a plutonium body burden of less than 10 nCi or 25 percent of the occupational exposure limit.

Individual B:

In this individual the evaluation of the magnitude of exposure and of any resultant body burden involved examination of four sets of data. These are A., information obtained by monitoring the home environment of the individual (Appendix B), B., the results of urine and fecal excretion bioassays (Appendix J), C., the results of the in-vivo internal radioactivity measurement (Appendices C and D), and D., the isotopic ratios of various samples (Appendix L).

A. Environmental Measurements:

Contamination levels in the apartment which Individual B shared with Individual A have been included in the R.O. investigation report. Individual B's car showed no evidence of contamination.

B. Bioassay Data:

1. Urine - Individual B showed no plutonium activity in 2 samples tested in 1974 between January and July. Slight plutonium activity was detected beginning November 8th and peaking on November 9th. By November 11th and 12th the activity had fallen below detection limits, where it remained through November 20th.

2. Feces - The first fecal sample, collected at Los Alamos Scientific Laboratory on November 11th, showed a level of radioactivity 3 orders of magnitude above background. Subsequent fecal samples, beginning with that of November 12th, showed very little or no activity.

C. In-Vivo Count Data:

In-vivo counting was carried out on Individual B on the 11th and 12th of November 1974 at Los Alamos Scientific Laboratory. The results are presented in Appendix C of the investigation report. No internal contamination was found.

D. Isotopic Ratios:

Two fecal samples, J-10 and J-23, revealed isotopic ratios of plutonium to americium of 18 and 15. These are well within the range of those found in the environmental samples of the apartment and in the fecal samples of Individual A, which averaged a ratio of 16.

Discussion and Conclusions:

1. Environmental levels do not suggest a high likelihood of the acquisition of a body burden of plutonium exceeding the permissible occupational limit by orders of magnitude.

2. The results of the urine and fecal bioassays, and the isotopic ratios suggest that Individual B's contamination probably involved the same radioactive material as found in Individual A and that the ingestion and inhalation took place shortly before the first positive bioassay result.

3. In view of the negative in-vivo counting result, and the relatively low level quantity of radioactive contaminants in the urine and feces, any internal deposition would have to be of a very low order of magnitude or a few percent of the permissible occupational burden at most. Since most of the activity simply passed through the gastrointestinal tract where absorption is minimal, the body burden, if any, is so small that there is no significant health hazard from this exposure.

Individual C:

In this individual the evaluation of the magnitude of exposure and of any resultant body burden involved examination of four sets of data. These are: A., the information obtained by monitoring the environment of the individual (Appendix B), B., the results of urine and fecal bioassays (Appendix K), C., the results of the in-vivo internal activity measurements (Appendices C and D), and D., the isotopic ratios of various samples (Appendix L).

A. Environmental Measurements:

Since Individual C had not worked at the Kerr-McGee plant since September, 1974, the probable source of contamination was the apartment of Individuals A and B. The levels of the contamination there have already been described in this report. Neither Individual C's residence nor his automobile showed any evidence of radioactivity.

B. Bioassay Data:

1. Urine - Appendix K reveals no plutonium detectable in urine samples collected intermittently from June 1971 until September 20th, 1974, after which the individual terminated his employment with Kerr-McGee. Urine samples produced on November 11th through 13th showed no increase over the past.

2. Feces - One fecal sample voided on November 11th was found by Los Alamos Scientific Laboratory to have a slight amount of plutonium and americium contamination. Subsequent samples on the 13th and 14th of November showed virtually no activity.

C. In-Vivo Counting:

In-vivo counting was carried out on Individual C on the 11th and 12th of November, 1974 at Los Alamos Scientific Laboratory. The results are presented in Appendix D of the investigation report. No plutonium or americium activity was detected.

D. Isotopic Ratios:

A plutonium to americium ratio of 9 was reported for the one fecal sample in which such data could be obtained.

Discussions and Conclusions:

1. The environmental levels in the apartment of Individual A and B were sufficiently low and the amount of time spent there by Individual C was comparatively small so the likelihood of the acquisition of a significant body burden exceeding the permissible limit by orders of magnitude is very low.

2. The absence of detectable activity in in-vivo counts and urine bioassays suggests that no significant internal contamination occurred in

Individual C. The very poor absorption to be expected by the passage of a relatively small amount of activity through the gastrointestinal tract likewise suggests that no significant body burden accumulated in this individual.

3. The comparatively low plutonium-americium ratio from the one analyzable stool sample is of uncertain significance since it is based on the analysis of a small sample with rather low levels of activity.

General Conclusions Concerning Biomedical Management:

1. Although the medical consultant for the Kerr-McGee company is knowledgeable and experienced, having served as medical director at the site in the past, his present location in another state makes it difficult to provide useful early input into the handling of contaminated individuals. In the present instance the magnitude and significance of the incident did not become clear and recognizable to the Kerr-McGee medical consultant until well beyond the time when his early intervention could have facilitated evaluation and disposition procedures for the three individuals concerned.

2. Capability of the local physician and clinic could not be assessed since the former was not a party to the interviews made in connection with this investigation.

3. Gross bioassay information was available locally through the Kerr-McGee research center with reasonable promptness. Their capability for carrying out accurate refined chemical isotopic analyses is not certain and should be tested.

4. The lack of local availability of any means for in-vivo assessment of plutonium and americium internal contamination is a major drawback in the biological and psychological management of contaminated individuals at this facility. Reliance on the capability of the Los Alamos Scientific Laboratory is a cumbersome means for obtaining such essential information although the reliability of the results is good.

5. Results of the biomedical investigations were provided to Individuals B and C in satisfactory fashion orally and in writing by the leader of the Health Division, Los Alamos Scientific Laboratory, and orally by the Kerr-McGee medical consultant.

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TABLE 4.1

SUMMARY OF TISSUE ANALYSIS RESULTS

Tissue Analyzed	Weight of Organ (g)	Weight Analyzed (g)	Activity (dis/min per gram) ^{239}Pu	Activity (dis/min per gram) ^{240}Pu	Activity (dis/min per gram) ^{241}Am	Isotopic Ratio (Percent of Total Activity) 239/240/241	Extrapolated Tissue Burden - $^{239-240}Pu$ dis/min	Extrapolated Tissue Burden - $^{239-240}Pu$ nCi
Duodenum								
Tissue	73.4[a]	7.0	N.S.[b]	N.S.	N.A.[c]			
Chyme		<0.1	122	28	0.1	84/14/0		
Intestine, Large								
Trans. Colon	113.9[a]	30.9	0.08	N.S.	0.01			
Feces		19.5	34.3	4.2	2.4	84/10/5		
Intestine, Small								
Tissue	386[a]	17.3	0.04	N.S.	N.A.			
Chyme		3.3	0.3	0.1	N.A.			
Liver	1311	19.0	5.4	0.7	0.2	86/11/3	0.8×10^3	3.6
Lung, Whole	995							
Parenchyma		17.2	10.1	1.3	0.6	84/11/5	1.1×10^3	5.0
Pleura		16.6	N.S.	N.S.	N.A.			
Lymph Nodes								
Periportal		3.3	0.2	N.S.	N.A.			
Tracheobronchial		6.7	1.8	0.3	0.1	82/14/4	1.4×10	.01
Stomach Wall	132.8	8.8	1.0	0.1	0.01	90/9/1	1.3×10^2	.06

[a] Including contents

[b] N.S. = not significant

[c] N.A. = not analyzed

TABLE 4.2

SUMMARY OF BONE ANALYSIS RESULTS

Specimen	Weight Received (g)	Weight Analyzed (g)	Activity (dis/min per gram) ^{239}Pu	Activity (dis/min per gram) ^{238}Pu	Extrapolated Skeletal Burden (nCi)
Rib	54	20	N.S.*	N.S.	—
Sternum	256	31	0.03	N.S.	0.14
Vertebra	81	33	0.01	N.S.	0.05
Femur	93	45	N.S.	N.S.	—

*N.S. = not statistically significant from background count level of 0.03 dis/min per sample aliquot.

Oklahoma Worker's Compensation Law*

85 Oklahoma Statutes § 11 [in pertinent part]

Every employer subject to the provisions of this Act shall pay, or provide as required by this Act, compensation according to the schedules of this article for the disability or death of his employee resulting from an accidental personal injury sustained by the employee arising out of and in the course of his employment, without regard to fault as a cause of such injury, and in the event of disability only, except where the injury is occasioned by the willful intention of the injured employee to bring about injury to himself or of another, or where the injury results directly from the willful failure of the injured employee to use a guard or protection against accident furnished for his use pursuant to any statute or by order of the State Labor Commissioner, or results directly from the intoxication of the injured employee while on duty . . .

85 Oklahoma Statutes § 12

The liability prescribed in the last preceding section shall be exclusive and in place of all other liability of the employer and any of his employees, at common law or otherwise, for such injury, loss of services or death, to the employee, spouse, personal representative, parents, dependents, or any other person, except that if an employer has failed to secure the payment of compensation for his injured employee, as provided in this Act, then an injured employee, or his legal representatives if death results from the injury, may maintain an action in the courts for damages on account of such injury, and in such an action the defendant may not plead or prove as a defense that the injury was caused by the negligence of a fellow servant, or that the employee assumed the risk of his employment, or that the injury was due to the contributory negligence of the employee; provided, that this Section shall not be construed to relieve the employer from any other penalty provided for in this Act for failure to secure the payment of compensation provided for in this Act.

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* Prior to 1978, known as the "Workmen's Compensation Law." The above-quoted sections were in effect at the time of Silkwood's alleged injury.